



Preventive Care Study: A Resource Orchestration View

A thesis submitted in fulfilment of the requirements for the degree of Doctor of Philosophy

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DECLARATION

I certify that except where due acknowledgement has been made, the work is that of the author alone; the work has not been submitted previously, in whole or in part, to qualify for any other academic award; the content of the thesis is the result of work which has been carried out since the official commencement date of the approved research program; any editorial work, paid or unpaid, carried out by a third party is acknowledged; and, ethics procedures and guidelines have been followed.

Noor Fadzlina Mohd Fadhil

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DEDICATION

To my adorable son Muhammad Altamis,

Many years of wild tantrums, cutest of smiles, joyous laughs and rolling tears; together we made this journey. Through you I learnt that the world is not only black and white but a myriad of colours. Thank you for always being my sweet inspiration and greatest teacher.

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LIST OF ABBREVIATIONS

ASEAN	Association of Southeast Asian Nations
BHIS	basic hospital information system
CCM	chronic care model
CDM	chronic disease management
CEM	chain of effect model
CNE	continuing nurse education
CRC	Clinical Research Centre
CT	computed tomography
DC	dynamic capability
EHR	electronic health record
EMR	electronic medical record
GDP	gross domestic product
HIS	hospital information system
HIT	health information technology
IHIS	intermediate hospital information system
IS	information system
IS/IT	information system/information technology
IT	information technology
ITD	Information Technology Department
MOH	Ministry of Health

MREC	Medical Research and Ethics Committee
MSC	Multimedia Super Corridor
NIH	National Institute of Health
NMRR	National Medical Research Registry
NSP-NCD	National Strategic Plan for Non-Communicable Diseases
RBV	resource-based view
SPS	structured-pragmatic-situational
TAM	technology acceptance model
THIS	total hospital information system
TID	theory of innovation diffusion
TOE	technology organisation and environment
TPB	theory of planned behaviour
TRA	theory of reasoned action
TTF	task-technology fit
UTAUT	unified theory of acceptance and use of technology
WHO	World Health Organization

ABSTRACT

Preventive care is identified as one of the most effective strategies to reduce the risk of chronic disease and healthcare spending. Chronic diseases are increasingly burdening developing countries, especially in Malaysia where the problem of rising healthcare costs and decreasing quality of care has intensified the situation. However, preventive care strategies have been poorly implemented and the growing impact of chronic diseases in developing countries remains challenging. A health information system is often cited as having the potential to contribute to chronic disease prevention and improved quality of care. However, research shows that most instances of ineffective preventive care is due to underutilisation, inadequacy and inappropriate use of resources. To further research this area, I adopted the structured-pragmatic-situational case study approach to examine how a hospital integrates resources that lead to information system competencies and information system capabilities in preventive care performance in a unique hospital in Malaysia. Within the context of resource-based theory, I utilised the concepts of resource orchestration and the chain of effect model as the main theoretical lenses through which I addressed the question. This research contributes to both theoretical research on resource development in healthcare and the resource-based theory. The main contribution of this research is the framework of information system competencies and information system capability development for hospital preventive care performance, which holistically incorporates the two types of resource bundling processes and the leveraging process that connects information system resources to preventive care performance. The research also provides lessons about managing limited preventive care resources for the targeted audiences of public hospitals in Malaysia, and hospital management that is currently providing, and going to implement, preventive care.

CHAPTER 1 – INTRODUCTION

This chapter provides an overview of the research undertaken for this thesis, which explored preventive care in a developing country, specifically regarding integrating information system/information technology (IS/IT) with non-IS/IT resources to assist with preventive care for chronic diseases. This chapter explains the context of the research, introduces the concept of preventive care in developing countries and introduces the theoretical background, presents the research objectives and questions, outlines the contributions of the research to the field and presents the thesis outline.

1.1 Context of the research

Preventive care has been identified as an effective strategy to reduce the risk of chronic diseases, such as cardiovascular disease, cancer and diabetes that occur in developing countries, helping patients to lead healthy lives (Kreiner & Hunt 2013; Rotarou & Sakellariou 2018; Sagner et al. 2016). Chronic diseases, commonly known as non-communicable diseases, are those that have a long duration and generally slow progression (World Health Organization (WHO) 2016). Research shows that chronic diseases present major public health problems, disability and death, and account for most of the healthcare expenditure in developing countries (George et al. 2018; Nugent 2008; Sagner et al. 2016). Without a significant strategy, such as preventive care, the human toll from chronic diseases remains unacceptably high in developing countries (WHO 2011), with the proportion of all premature chronic disease deaths almost double the rate of developed countries (WHO 2018).

Most developing countries are faced with the burden caused by chronic diseases, with an expected increase in mortality rates (WHO 2011). Eighty-five per cent of the chronic disease mortality rate (of those aged between 30 and 70 years) occurs in developing countries (WHO 2014a, 2016). Such a high mortality rate in developing countries poses significant importance on the need for preventive care, with a corresponding increase in related research (Bloomfield et al. 2016; Jones & Geneau 2012; Mukakalisa et al. 2014; Sagner et al. 2016; Tibazarwa & Damasceno 2014). In short, preventive care has become a central issue for healthcare organisations to address.

However, preventive care strategies have been poorly implemented in developing countries (Adonis et al. 2016; Mukakalisa et al. 2014; Van Minh et al. 2014), with the actual rates of preventive care service delivery remaining low (Chen, Lin & Lin 2013; McElwaine et al. 2014). Some studies suggest that the use of a hospital information system (HIS) by health organisations can provide a significant improvement in preventive care (Ahmad & Tsang 2013; Bauer et al. 2014b; Nohara et al. 2015), by enabling healthcare practitioners to track patient records and empower them with information about their health (Ahmad & Tsang 2013).

Despite the expected benefits of HIS contributing to chronic disease prevention and improved quality of care (Jabbour et al. 2003; Monsted 2018; Nohara et al. 2015), evidence suggests HIS cannot serve as a substitute for healthcare practitioners, and is meant to only support them in facilitating preventive care (Nilsson, Skär & Söderberg 2010). Moreover, healthcare organisations are inconsistent in utilising the technology and other available resources for preventive care (Gandjour 2012; Goldstein et al. 2014; Lee, Chiang & Liu 2018; McDonald et al. 2011). There appear to be three main issues concerning resources; underutilisation (Clauser et al. 2011; Van Minh et al. 2014), inadequacy (Gandjour 2012; Van Minh et al. 2014) and inappropriate use (Hung et al. 2007). These issues have become a key challenge for many healthcare organisations that are trying to provide greater prevention of chronic diseases (Gandjour 2012). In essence, healthcare organisations have to find solutions to make the best use of scarce resources for preventive care (Van Minh et al. 2014).

To make the best use of these limited health resources, there is a need to integrate information technology (IT) resources, human-IT resources and intangible-IT resources (Bharadwaj 2000) to deliver quality preventive care services to patients. Hence, the research question posed by this research is:

How does a hospital integrate resources that lead to information system competencies and information system capabilities in preventive care performance?

To understand the purpose, aims and significance of this research, the rest of this chapter is organised in six sections; preventive care in developing countries (including the problem statements and theoretical background), research question and

objectives, the research case study, the contribution of the research and finally, the thesis outline.

1.2 Preventive care in developing countries and theoretical background

Preventive care has become a prominent approach for reducing the rising incidence of chronic diseases (Ebrahim et al. 2013; Lee, Chiang & Liu 2018; Mittra 2011; Mukakalisa et al. 2014; Risso-Gill et al. 2015; Srinivas & Paphitis 2016). However, the lack of preventive care has made reducing the impact of chronic diseases in developing countries challenging (Ibrahim 2018; Lee, Chiang & Liu 2018; Mukakalisa et al. 2014; Mwai & Muriithi 2015). Studies show that worldwide cumulative losses from chronic diseases will amount to US\$47 trillion in the coming 20 years (Bloom et al. 2012). Such figures can cause a significant financial burden on both the economy and public wellbeing, which is likely to increase over time (Cappuccio & Miller 2016; Muka et al. 2015). The prevalence of chronic diseases has gone beyond the communicable disease burden and has impacted developing countries, including Malaysia (Huri et al. 2016; Mahmud & Aljunid 2018; Risso-Gill et al. 2015). This research is focusing on particular chronic diseases such as diabetic, heart problem, hypertension and cancer because these type of chronic diseases are reaching worrying levels in Malaysia. A health report shows that diabetes and obesity are highly found among patients in Malaysia (MOH Malaysia 2016). Studies have reported that in Malaysia, the colorectal cancer incidence rate was estimated at 21.32 cases per 100,000 and the death rate was 44.7% from 2008 to 2013 (Hassan et al. 2016); one of the leading causes of cancer-related deaths globally (Magaji et al. 2017; Yan et al. 2017). Moreover, diabetes in Malaysia has a huge impact on the country, estimated at RM2 billion (MOH Malaysia 2016).

Also, statistics show that chronic diseases are estimated to account for 74% of total deaths (154,000) in Malaysia (WHO 2018). This problem has become a huge burden for the Malaysian healthcare system, which is reflected in increasing healthcare spending as shown in Table 1.1 and Figure 1.1.

Table 1.1: Estimated healthcare spending in four Southeast Asian countries, adapted from Deloitte (2015)

Country	Estimated healthcare spending in US\$		Increase US (\$)	Increase (%)
	2013	2018		
Malaysia	13.7 billion	22.9 billion	9.2 billion	67
Singapore	11.6 billion	17.8 billion	6.2 billion	53
Philippines	12.5 billion	20.0 billion	7.5 billion	60
Thailand	12.8 billion	18.7 billion	5.9 billion	46

Table 1.1 shows the estimated healthcare spending for four Southeast Asian countries for 2013 and 2018 (Deloitte 2015). In particular, the projected healthcare spending for Malaysia in 2018 is higher than the other Southeast Asian countries; 67%.

I selected a healthcare organisation in Malaysia as a case study because of Malaysia's high volume of spending in healthcare compared to Singapore, the Philippines and Thailand (Deloitte 2015). Despite the high level of spending, Malaysia also has high chronic disease mortality rates (WHO 2018). For example, the probability of dying between the ages of 30 and 70 years from the main chronic diseases in Malaysia (17%) shows a similar trend to that of Vietnam and is fairly similar to that of Thailand (14%) (WHO 2018). Thus, Malaysia presents an interesting case study for this research.

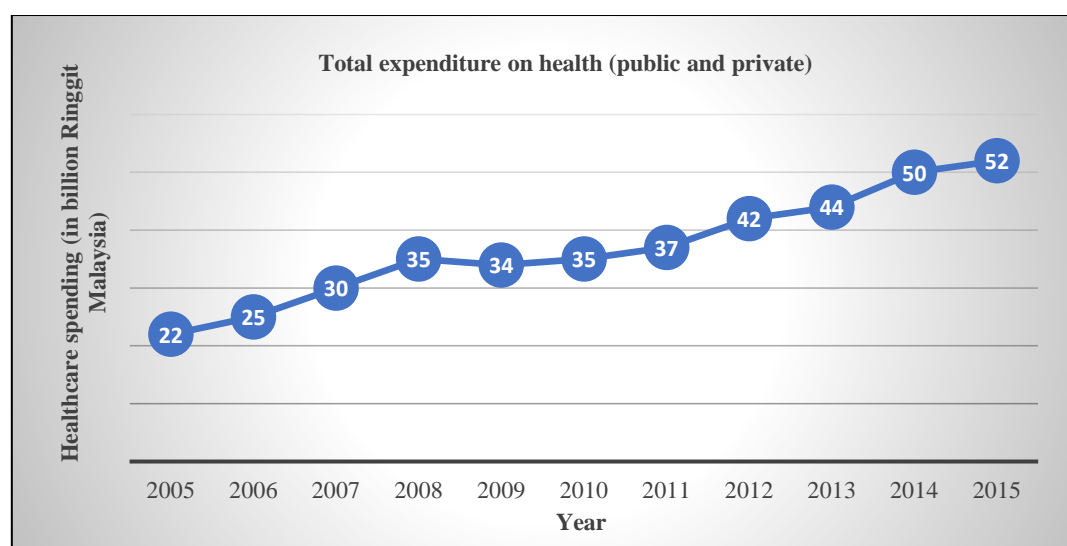


Figure 1.1: Total healthcare spending by Malaysia (in billion ringgit) compiled from the Ministry of Health Malaysia from 2005 to 2017

As depicted in Figure 1.1, The Ministry of Health (MOH) Malaysia (2017) also reports that the total healthcare spending in Malaysia has been increasing, and is expected to continue rising.

Recognising the excessive impact of chronic diseases on society and the economy, preventive care has been established as a strategy that can save not only millions of lives but billions of dollars (Kottke et al. 2011; Kreiner & Hunt 2013; Seffrin 2011). For this reason, I explored preventive care in a developing country – Malaysia.

Healthcare organisations do not always consistently utilise the available resources for preventive care (Cappuccio & Miller 2016; Goldstein et al. 2014), with three main issues.

First, resources are underutilised in preventive care because of poor infrastructure, and the inexperience of healthcare practitioners (George et al. 2018; Tibazarwa & Damasceno 2014). In addition, the lack of a clear vision and strategy for chronic disease prevention and control also results in underutilised resources in health organisations in many developing countries (Cappuccio & Miller 2016; Mwai & Muriithi 2015; Van Minh et al. 2014).

Second, studies report that resources are inadequate for preventive care (Gandjour 2012; Van Minh et al. 2014) because health organisations face major cost problems and organisational challenges, such as requiring infrastructure and trained human resources (Ali, Shah & Tandon 2011; Fuster & Kelly 2011), and equal distribution of resources (Dye et al. 2010; Giri et al. 2018; Nitardy et al. 2016; Rotarou & Sakellariou 2018; de Vries et al. 2018).

Third, there is an issue of inappropriate use of resources, which can cause medical errors (Saleem & Masood 2016), repetition in clinical care and can incur unnecessary costs (McDermott 2013). HIS is important to enhance preventive care delivery (Harris et al. 2017); however, it is not always regularly used by healthcare staff (Waibel et al. 2016), and the information from HIS is not widely shared for decision-making to deliver effective preventive care services (Askar, Ardakani & Majdzade 2017; Hung et al. 2007).

These major concerns make it difficult for healthcare organisations to play their role in providing successful preventive care. As a result of these issues, it is important to study the relationships between healthcare resources and how they influence preventive care. As evident in previous studies, resource issues could lead to poor preventive care. Thus, HIS is often cited as one of the resources with the potential to contribute to chronic disease prevention and improved quality of care (Jabbour et al. 2003; Monsted 2018; Nohara et al. 2015).

HIS is identified as an important resource to support the delivery of preventive care (Ahmad & Tsang 2013; Bauer et al. 2014b; Bernardi 2017; Mishuris & Linder 2014; Shih et al. 2011). For example, Bauer et al. (2014b) and Ahmad and Tsang (2013) highlight that the use of HIS in preventive care could improve accessibility to patient records, provide convenience and increase the quality of care while reducing healthcare costs. In addition, the importance of having technological resources such as HIS in preventive care is especially relevant for healthcare organisations (Nohara et al. 2015; Zayyad & Toykan 2018), as without HIS most healthcare reports are dependent on paper-based formats where the information obtained is inconsistent (Van Minh et al. 2014). Moreover, without HIS, patient records are disorganised, which can lead to information being misplaced (Van Minh et al. 2014), direct injury to patients, increased medical expenditure, and safety and quality service failures (Harrison, Cohen & Walton 2015). For instance, Nguyen et al. (2014) report that more than half of all medication in their study in a developing country was prescribed at the incorrect time (54.7%). Another study found an error rate of 66% in paper-based prescribing, compared to 42% in electronic prescribing, which is similar to findings reported in developed countries with correct prescribing rates ranging from 40.5% to 100% (Shawahna et al. 2011). Thus, electronic prescribing significantly reduced medical errors and improved healthcare quality (Shawahna et al. 2011).

However, many of the studies that have investigated health technology resources such as HIS (Bawack, Robert & Kamdjoug 2018; Bernardi 2017; Moghaddasi et al. 2018) in preventive care (Ozok et al. 2014; Tuckson 2013), tend to overemphasise technical issues and do not account for human and organisational aspects (Negash et al. 2018; Yusof 2015). Previous studies also show little attention to the integration of information

system (IS) resources, such as human resources and managerial mechanisms, in improving preventive care (Clauser et al. 2011; Shaw et al. 2011).

Given the lack of health resource integration, this current research was necessary to improve understanding about how to integrate scarce healthcare resources by using HIS with other IS resources to facilitate preventive care service delivery. Preventive care has a service focus and is difficult to generate (Negash et al. 2018). It requires the involvement of healthcare practitioners as key stakeholders with the use of healthcare resources such as HIS technology, data and processes to achieve better-quality care (Negash et al. 2018). More specifically, without healthcare practitioner involvement, any input from HIS would just be part of the critical information contributing to preventive care (Negash et al. 2018).

In order to achieve better preventive care performance, healthcare organisations cannot rely solely on IT resources such as HIS. Instead this resource should be integrated with other IS resources (Clauser et al. 2011; Hersh et al. 2010), such as healthcare practitioner skills, experience and knowledge (human-IT resources) (Bharadwaj 2000; Hersh et al. 2010; Sinha & Sinha 2015; Zakaria & Yusof 2016) and knowledge assets, synergy and patient orientation (intangible-IT resources) (Bharadwaj 2000). Healthcare resource integration could lead to optimal use of HIS by healthcare practitioners (Deimazar et al. 2018; Sabbath et al. 2018), thus achieving quality preventive care services to patients in developing countries (Jabbour et al. 2003).

Previous studies argue that the effectiveness of preventive care service delivery could only result from the integration of IS resources, comprising tangible, human and intangible-IT resources (Bharadwaj 2000; Clauser et al. 2011). Therefore, a combination of, and interaction between IS resources are required and should be considered as crucial in creating IS competencies and IS capabilities, which in turn help an organisation obtain better performance (Cragg 2008; Tarafdar & Gordon 2007; Teoh 2010).

In this research I adopted the resource-based view (RBV) theory as the foundation to understand IS resources, IS competencies and IS capabilities. I also expanded on the use of RBV by applying the resource orchestration perspective of RBV and the chain

of effect model (CEM) to develop a conceptual model to research IS competency and capability development towards hospital preventive care performance. Moreover, I adopted the perspectives provided by resource orchestration and CEM to examine the processes of how IS resources interact, create value and influence preventive care. Within these perspectives, the value of IT combined with other IS resources, and the indirect effect of these resources towards organisational performance, can be better explained so healthcare organisations will be able to recognise the benefits of using IT, and how it interacts with IS-related resources towards achieving quality preventive care.

Hence, the purpose of this research is to understand how a hospital integrates resources that lead to IS competencies and IS capabilities in preventive care performance.

1.3 Research question and research objectives

The research question that guides the research is:

How does a hospital integrate resources that lead to information system competencies and information system capabilities in preventive care performance?

To assist in answering the main research question, I created two sub-questions with corresponding objectives. The main focus of the objectives is to identify and understand how IS competencies and capabilities are developed, as outlined in Table 1.2.

Table 1.2: Research questions and research objectives

No.	Sub-research questions	Research objectives
1.	What information system competencies and information system capabilities are utilised in preventive care?	To identify the information system competencies and information system capabilities utilised in preventive care.
2.	How are information system competencies and information system capabilities developed for preventive care?	To identify how the information system competencies and information system capabilities are developed in preventive care.

1.4 Research case study

In addition, Malaysia has invested so much on its healthcare platform, but is still not able to utilise its resources for better-quality health outcomes. Thus, the issues of underutilised resources, inadequate resources and inappropriate use of resources provided a rich environment for this research.

Furthermore, I conducted this research in the Malaysian public healthcare system because it represents a major part of the healthcare sector in Malaysia with more than 1,000 healthcare organisations (MOH Annual Report 2012) serving the largest number of patients in the country, as shown in Figure 1.2 (Economic Planning Unit 2010).

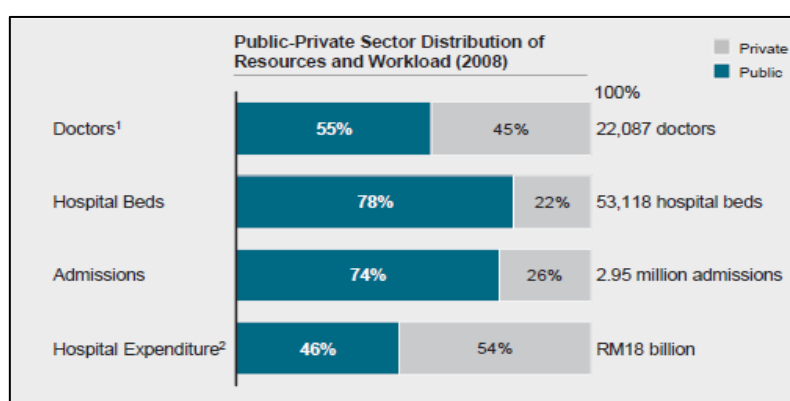


Figure 1.2: Malaysian public hospital resources (Economic Planning Unit 2010)

The purpose of selecting a single case of a public hospital in Malaysia, which in this research is named ABC Hospital (a pseudonym used for privacy issues), is not to generalise its findings to the population but rather to provide an in-depth understanding of the phenomenon being studied (Yin 2014) or referred to in a case (Miles & Huberman 1994). I based the selection of a single hospital on several characteristics. First, this hospital provides many preventive care services. Second, it has rich and

complex experiences in using HIS to support preventive care services, hence providing a compelling case for exploring the integration of IS resources for preventive care. Third, this hospital is large, with more than 1,000 employees. With its complex working environment, the hospital provided an opportunity for me to understand the phenomenon by having close interactions with the healthcare practitioners. Fourth, this hospital is known as a health referral centre for other district hospitals. Thus, its specialties in different care services, including preventive care, made it an interesting case for exploring the phenomenon. Chapter 3 provides further elaboration on the selection of ABC Hospital as the case organisation for this research.

This research set out to explore the events that occurred between IS resources and preventive care performance in a single public hospital in Malaysia. I chose a public hospital equipped with HIS so I could explore the integration of its IS resources towards improving preventive care.

The identification of the link between resources and performance is based on the RBV theory using resource orchestration and CEM perspectives. In addition, I used this analytical lens to unpack the mechanisms that help transform IS resources into IS competencies and IS capabilities for preventive care. The research focused on how IS competencies and capabilities are developed from three IS resources – tangible, human and intangible-IT resources (Bharadwaj 2000) – towards preventive care performance.

I adopted a qualitative approach (Eisenhardt 1989) referred to as soft positivism (Kirsch 2004; Madill et al. 2000) with in-depth case studies in the IS field (Eisenhardt 1989; Yin 2003; Walsham 1995), and sought information from one healthcare organisation to identify the IS competencies and capabilities, and explain how these resources are developed and integrated to achieve preventive care.

I collected data by conducting in-depth interviews with a total of 40 participants, analysing documentation and archival records, and writing field notes. I collected the data over eight months, between August 2016 and March 2017. I used semi-structured interviews as the main method of determining the research information. I also used archival records and documentation in conjunction with other sources of information, such as hospital handbooks and annual hospital reports to gather relevant information.

I also used field notes to reflect on interesting information during the interviews. The use of field notes also served as an opportunity to plan for the next interview.

I systematically analysed the data using manual coding to generate thematic analyses of the important underpinning constructs, using the structured-pragmatic-situational (SPS) approach (Pan & Tan 2011) and enhanced by the work of Yin (2014; 2016), Saldana (2013) and Miles, Huberman and Saldana (2014). I used three levels of codes (Saldana 2013). Level 1 codes were formed from the original data, which included holistic codes and in-vivo codes. Level 2 codes, also known as category codes, that belonged to similar groups were placed under a category. Level 3 codes, or themes, were formed when I found patterns from the codes and categories.

Finally, I employed a few strategies, for instance, narrative strategy (Pan & Tan 2011) supported by logic models (Yin 2014) and table of matrix display (Miles, Huberman & Saldana 2014) to obtain and interpret meanings of the research constructs or themes, thus helping to answer the research question. These strategies helped me derive the framework, which suggests two types of resource bundling processes that integrate resources for preventive care, and reveals six IS competencies and four IS capabilities.

1.5 Research contributions

This research contributes to both theoretical and managerial aspects of healthcare.

The main theoretical contribution of this research is the two types of resource bundling processes that integrate resources for preventive care. This research also contributes to the framework of IS competency and IS capability development for hospital preventive care, which shows the two types of resource bundling processes and the development of the six IS competencies, and four IS capabilities for preventive care.

Second, this research adds to the literature on resource development and the concepts of IS competencies and IS capabilities (Peppard & Ward 2004) in the field of healthcare (Burton & Rycroft-Malone 2014), mainly preventive care in developing countries (Jones & Geneau 2012).

Third, the research framework contributes to the preventive care literature by introducing three main interrelated aspects of preventive care concepts – administrative efficiency, health promotion and quality of care.

Fourth, this research contributes to HIS research on how a hospital could use its HIS to deliver quality preventive care services to patients.

Fifth, this research contributes to the RBV theory by expanding the theory through the application of the resource orchestration perspective. The use of resource orchestration explains that when IS resources are appropriately managed and integrated, they will transform into IS competencies and capabilities, and through the leveraging of IS capabilities, preventive care performance is achieved.

Sixth, the combination of resource orchestration and CEM refines the resource orchestration perspective. Resource integration through the two types of resource bundling processes of IS competencies and IS capabilities proposed by this research further expands on the work of Sirmon et al. (2011) on the resource orchestration perspective.

This research also provides important insights from the managerial aspect on how to integrate resources to address underutilisation, inadequacy and inappropriate use of resources in the context of preventive care. Based on the case findings, I suggest nine strategies where further actions are required by three main targeted audiences; public hospitals in Malaysia, hospital management currently providing preventive care, and hospital management planning to implement preventive care.

Specifically, I provide three main recommendations in this thesis. First, for public hospitals in Malaysia to i) promote joint learning about preventive care, ii) implement the preventive care concept of train-the-trainer, and iii) share the best preventive care practices among hospitals. The strategies introduced could provide opportunities for Malaysian public hospitals to create innovative solutions in managing and integrating scarce resources, thus contributing to providing quality preventive care services.

Second, for hospital management currently providing preventive care to i) review the availability of limited healthcare resources to design strategies for internal resource development, ii) mentor junior healthcare practitioners throughout preventive care

processes, and iii) establish volunteer care teams to nurture preventive care practices. The strategies could be a continuous effort by the hospital to maintain existing preventive care service or make changes to improve preventive care delivery for patients in the future.

Third, hospitals planning to implement preventive care but experiencing limited resources could consider the following options: to i) mix-and-match healthcare practitioner preventive care skills, ii) identify experts within the hospital by assessing healthcare practitioner preventive care awareness, experience, skills and knowledge, and iii) provide necessary preventive care related training through prioritisation. The strategies suggested could assist hospitals that are planning to implement preventive care to set up a plan for establishing preventive care services.

1.6 Thesis outline

This thesis consists of seven chapters. This first chapter provided an overview of the research, including the research problems, research questions and objectives that guided the research. The rest of the chapters are outlined as follows:

Chapter 2 provides the literature review, which further explores the research content, issues and theories. It also discusses HIS usage, preventive care and underpinning theories in detail.

Chapter 3 highlights the appropriate research paradigm, research design and methods for this research. It justifies qualitative case study approach (Eisenhardt 1989) referred to as soft positivism orientation (Kirsch 2004; Madill et al. 2000). Also, it explains the rationale for selecting a single case study approach. Chapter 3 also highlights the necessary ethics procedures for data collection processes.

Chapter 4 elaborates on the background of ABC Hospital, and preventive care service and patient processes in the hospital.

Chapter 5 presents the analysis and findings from the interviews conducted with the participants. This chapter also highlights the themes that emerged and significant findings from the data analysis.

Chapter 6 discusses the finalised themes and the compatibility of the findings with the theories.

Chapter 7 concludes this thesis, emphasising how the research questions were answered. Chapter 7 also highlights the recommendations and presents an overall reflection of the case study.

CHAPTER 2 – LITERATURE REVIEW AND CONCEPTUAL MODEL

This chapter presents the literature review and clarifies the conceptual model used in this research.

First, it defines the terms used in this research before explaining the impact of chronic diseases on developing countries such as Malaysia. A discussion about preventive care as a strategy to address chronic diseases follows. This chapter then explains the healthcare system in developed and developing countries, and how preventive care is undertaken in developing countries. This is followed by an explanation of IS competencies and IS capabilities, their definitions and the need to research these concepts in the preventive care area. Finally, this chapter presents the theories and theoretical lenses applied in the research.

2.1 Information system/information technology and hospital information system

In this thesis, I use the term *information system* to describe the combination of technical components, and human activities within an organisation (Wade & Huland 2004), as well as the process of managing the life cycle of organisational, IS practices (Avgerou & McGrath 2007). I use the term *information technology* to refer to the hardware and software purchased and developed internally in the hospital (Saunders & Brynjolfsson 2016).

HIS definitions have varied meanings according to different researchers (McKenna, Dwyer & Rizzo 2018). However, according to one definition, HIS is a system that collects and disseminates data systematically (Borzekowski 2009) that evolves into an integrated system that manages the information of entire hospital processes (Ahmadi, Nilaishi & Ibrahim 2015; Amin, Hussein & Isa 2011; Handayani, Rahman & Hidayanto 2013). This definition appears to be consistent with what I observed in the case study for this research. Hence, in this research, HIS is defined as an integrated system that manages the overall hospital operations and administration to improve healthcare service delivery.

2.2 Chronic diseases in developing countries

Deloitte (2018) reports that total world health expenditure is rising annually, from 1.3% of global gross domestic product (GDP) in 2012–2016 to 4.1% in 2017–2021. Healthcare expenditure is increasing in North America, Western Europe, the Middle East, South Africa and the Asia Pacific. Deloitte also reports that the increase in health expenditure is due to the major issues of an ageing population, chronic diseases, rising healthcare costs, advances in medical treatment, the increasing need for integrated healthcare systems and rising labour costs (Deloitte 2014, 2018). An ageing population and increasing life expectancy are placing a huge burden on healthcare costs in countries with the highest proportion of older individuals, for example, Western Europe, Japan and China. Moreover, in the United States of America and the United Kingdom, healthcare costs are expected to continue to rise, and government health expenditure has substantially increased (Deloitte 2018). Africa, the Middle East and Asia are experiencing substantial economic burdens because of chronic disease epidemics (Deloitte 2014; Muka et al. 2015).

Chronic diseases have become the most challenging issue in human health and a major threat to developing countries' economic development and growth (Li et al. 2018; Quarti Machado Rosa et al. 2018), with rapid urbanisation, a sedentary lifestyle, changing diet and rising obesity levels fuelling the increase (Deloitte 2018). Globally, diabetes has increased from 415 to 642 million cases, with developing countries such as China and India leading the world with the largest number of diabetes sufferers at around 114 million and 69 million, respectively (Deloitte 2018).

Moreover, chronic diseases have a massive impact on a country, weakening productivity and increasing healthcare expenditure (Bloom et al. 2012; Hsieh et al. 2016; Sarkar et al. 2017). Deaths from chronic diseases are mainly from cardiovascular illness, cancers, chronic respiratory diseases and diabetes (Lim et al. 2014; WHO 2017). As the primary cause of death globally, chronic diseases were responsible for 41 million of the world's 57 million deaths (71%) in 2016 (WHO 2018). Chronic diseases have also caused over 15 million deaths of people between the ages of 30 and 70 years, and 85% of those are in developing countries (WHO 2018). The statistics show that deaths from chronic diseases occur across high-income to low-income countries (WHO 2005, 2013, 2018).

A report by the World Economic Forum and the Harvard School of Public Health suggests that, worldwide, cumulative losses from chronic diseases will amount to US\$47 trillion from 2010 to 2030 or 75% of global GDP in 2010 terms (US\$63 trillion) (Bloom et al. 2012). Although substantial economic burden from chronic diseases is encountered by high-income countries, the developing world, especially middle-income countries, is expected to experience an ever-greater burden as their economies and populations grow. The presence of chronic diseases has gone beyond the communicable disease burden in developing countries (Hajat & Stein 2018) because these countries are increasingly adopting the unhealthy lifestyles of the developed world (WHO 2018).

The assumption that chronic diseases primarily exist in developed countries, with communicable diseases occurring in developing countries, is now untrue (Nugent 2008). Developed countries, such as Finland, Taiwan and South Korea, have low mortality rates from chronic diseases. In contrast, Canada and the United Kingdom have higher death rates from chronic diseases than communicable diseases (Nugent 2008). Nevertheless, chronic disease death rates in these developed countries are far lower compared to many developing countries. According to the WHO (2011), without intervention, deaths from chronic diseases are predicted to increase by 15% between 2010 and 2020. The biggest increase will occur in Africa, the Eastern Mediterranean and the Southeast Asian region. For example, developing countries in Southeast Asia have great challenges dealing with communicable diseases, and unfortunately, now a chronic disease burden is added. Both types of diseases contribute to increasing the countries' health expenditure and mortality rates (WHO 2011).

Southeast Asia consists of more than half a billion people from high-income countries such as Singapore and Brunei; middle-income countries such as Malaysia, Thailand, Vietnam, the Philippines and Indonesia; and low-income countries such as Cambodia, Laos, Timor-Leste and Myanmar. All are struggling with both communicable and chronic diseases, although the trends in mortality rates vary according to each type of disease. While low-income countries such as Myanmar, Laos and Cambodia still predominantly have communicable diseases, other countries are now dealing with chronic diseases. Concurrently, all countries in this region are challenged with looming chronic disease epidemics, with chronic diseases already killing more people than

communicable diseases and other diseases that occur before old age (see Table 2.1). Like other countries, Malaysia also has to deal with the continuing challenges arising from chronic diseases, with a high mortality rate of 74% of total deaths (WHO 2018), as shown in Table 2.1.

Table 2.1: Chronic diseases and the percentage of total deaths (WHO 2018)

Country	Mortality rate from chronic diseases (% of total deaths, all ages, both sexes)	Probability of dying between ages of 30 and 70 years from one of four main chronic diseases (%)
Singapore	74	9
Brunei	85	17
Thailand	74	14
Malaysia	74	17
Philippines	67	27
Vietnam	77	17
Indonesia	73	26
Timor-Leste	45	20
Laos	60	27
Cambodia	64	21
Myanmar	68	24

Statistics show that in Malaysia, the 74% chronic disease mortality rate is estimated to consist of 35% from cardiovascular disease, 16% from cancer, 4% from chronic respiratory disease, 3% from diabetes and 16% from other chronic diseases, with 17% from communicable, maternal, perinatal and nutritional conditions, and 9% injuries, as shown in Figure 2.1.

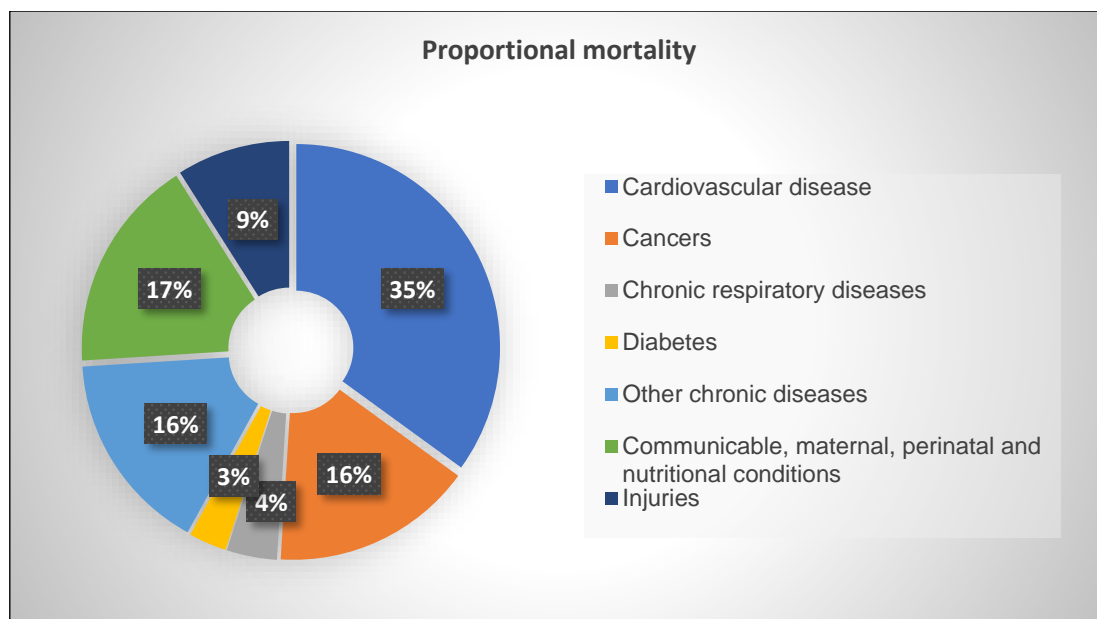


Figure 2.1: Proportional mortality in Malaysia (% of total deaths, all ages, both sexes) (World Health Organization 2018)

The emergence of chronic diseases as the leading cause of death worldwide, including Malaysia, has prompted the Malaysian Government to present this scenario in several important national documents (Azmi et al. 2018; Mustapha et al. 2014). For example, the Malaysian Government developed the National Strategic Plan for Non-Communicable Diseases (NSP-NCD) 2016–2025 to strengthen Malaysia’s response to chronic disease prevention (MOH Malaysia 2016). The strategic plan is set out to address the significant and increasing threats posed by chronic diseases in Malaysia and includes the provision of preventive healthcare services. The strategic plan also provides chronic disease data and risk factors (MOH Malaysia 2016).

For example, Malaysia has the highest prevalence of diabetes and obesity among other Southeast Asian countries (MOH Malaysia 2016). The cost of diabetes to the Malaysian nation is significant at approximately RM2 billion, representing 13% of GDP reported in the healthcare budget for 2011 (MOH Malaysia 2016). Table 2.2 presents selected chronic disease risk factors for Malaysian adults aged 18 years and over from 2006 to 2015.

Table 2.2: Selected chronic disease risk factors for Malaysian adults aged 18 years and over from 2006 to 2015 (Ministry of Health Malaysia 2016)

Chronic disease risk factors	2006 (%)	2011 (%)	2015 (%)
Diabetes mellitus	11.6	15.2	17.5
Hypertension	32.2	32.7	30.3
Hypercholesterolemia	28.2	43.9	47.7
Overweight	29.1	29.4	30.0
Obesity	14.0	15.1	17.7
Physical inactivity	56.3	64.3	66.5
Smoking*	21.5	23.1	22.8
Alcohol (current drinker)	11.4	11.6	7.7

* data for population 15 years and over

Preventive care, therefore, continues to be an important national agenda item in Malaysia. Chronic disease prevention is documented in many national documents. For example, the Tenth Malaysia Plan 2011–2015 (Economic Planning Unit 2010) highlights a shift towards wellness and disease prevention. It reports that factors such as increased income, behavioural change, stressful lifestyle, unhealthy food intake, and alcohol and tobacco consumption have led to chronic diseases such as cardiovascular disease, hypertension and diabetes. The high risk of developing these diseases has implications for healthcare organisations in terms of healthcare costs, and demand for relatively expensive treatment and long-term rehabilitative care. Given limited measures and big challenges, there is a need to transform the healthcare system in preparation for the very real hurdles of a high prevalence of chronic diseases as well as unexpected environmental and communicable threats to health. Becoming a developed nation requires the health sector to prepare for higher quality and safe health system that efficiently utilises all the available health resources for greater access to more effective care in line with the needs of Malaysians. The Malaysian health-system review and Malaysian preventive care are further explained in Sections 2.4.3 and 2.4.4.

In summary, Malaysia was selected as a case for this research because of the high volume of its expenditure in healthcare industries compared to other developing countries. Despite its expenditure on health, Malaysia is among the highest Southeast Asian countries with chronic disease mortality rates (WHO 2018) (refer to Table 2.1) and with a high prevalence of chronic disease risk factors (MOH Malaysia 2016).

Therefore, Malaysia provides an interesting research environment, given that Malaysia has invested so much in its healthcare platform and is very committed to addressing the chronic disease epidemic while not fully successfully having better-quality health outcomes. Thus, the issues of underutilisation of resources, inadequate resources and inappropriate use of resources discussed in Chapter 1 provide compelling motivations for this case study.

2.3 Preventive care for chronic diseases

The increasing chronic disease crisis around the world has become a major health problem requiring immediate action, such as the implementation of preventive care (Allison et al. 2016; Maher, Ford & Unwin 2012; Vandenberghe & Albrecht 2018; WHO 2017). For example, a report by the WHO, *Preventing Chronic Diseases: A Vital Investment*, highlights issues specific to chronic diseases, and current action strategies and plans for chronic disease control and prevention (WHO 2005). Chronic diseases have become the main issue for several reasons. First, chronic diseases are the major contributors to death and disability worldwide, and they are a growing issue in developing countries (WHO 2014a). Second, it is evident that developing countries face a dual burden through an increase in chronic diseases while communicable diseases remain a significant part of their public health problems (Boutayeb 2006; Bygbjerg 2012; Sagner et al. 2016). Third, chronic diseases have a huge negative social and economic impact on countries that suffer from them (Bloom et al. 2012; Lim et al. 2014). Fourth, the causes of many chronic diseases are unknown; therefore, ways to prevent them remain elusive (Ebrahim et al. 2013; Srinivas & Paphitis 2016).

Preventive care for chronic diseases is identified as an effective strategy, and is essential to keep people healthier with a higher quality of life, and to provide value for health spending (Bednarczyk et al. 2018; Kreiner & Hunt 2013). Despite evidence that preventive care can reduce the risk of chronic diseases and healthcare costs, research indicates that uptake of such services is generally low (Gandjour 2012; Peng & Lin 2018). Previous studies have found that lower rates of preventive care service use are generally associated with resource scarcity, such as limited funding for controlling the disease, and the need for stronger national leadership support (Dans et al. 2011); lack of health insurance coverage (Eno, Mehalingam & Nathaniel 2016); inadequate policies, legislation and regulations, (Beaglehole et al. 2011); financial constraints and

shortages in human resources (Cappuccio & Miller 2016; Kruk, Nigenda & Knaul 2015); governance, health information, and limited medical products and technologies, such as cardiac rehabilitation facilities (Sagner et al. 2016), mammography machines and laboratories (Mitchell-Fearon et al. 2015); and health-service delivery (Samb et al. 2010). As a result, the inability to maximise the use of scarce resources (Dans et al. 2011) leads to poor utilisation of preventive care (Eno, Mehalingam & Nathaniel 2016; Hoeck et al. 2014; Kruk & Freedman 2008; Mitchell-Fearon et al. 2015).

Developing countries currently facing a chronic disease burden (Boutayeb 2006; Cappuccio & Miller 2016; Ibrahim 2018; Stephani, Opoku & Quentin 2016) are expecting an increase in mortality rates like that experienced in the developed world (WHO 2011). The leading causes of chronic disease deaths are heart disease, stroke, cancer, chronic respiratory diseases and diabetes, with the highest proportion of deaths to people under the age of 70 years (WHO 2014b). The high mortality rate in developing countries poses significant importance on the need for preventive care, which has been a central issue for researchers (Mohan, Seedat & Pradeepa 2013; Sagner et al. 2016). For example, in Malaysia, an increase in life expectancy and a reduction in infant and maternal mortality rates was reported in the Eleventh Malaysia Plan 2016–2020 (see Table 2.3), as a result of the Malaysian Government’s efforts in improving its preventive care service, promoting healthy lifestyles, upgrading healthcare amenities and strengthening the capacity of healthcare personnel (Economic Planning Unit 2015).

Table 2.3: Selected indicators for health status 2010 and 2014 (Economic Planning Unit 2015)

Indicator	2010	2014 (estimated)
Life expectancy at birth (in years)	74.1	74.8
Infant mortality rate (for every 1,000 live births)	6.7	6.5
Maternal mortality ratio (for every 100,000 live births)	26.1	25.5

Substantial research in the preventive care area would lead to a better understanding of how to provide healthcare organisations with a strategy to address the risk and implications of chronic diseases in developing countries. A considerable amount of research already exists on preventive care. Sarkar et al. (2017) undertook a study in tertiary healthcare facilities regarding preventive care service, including follow-up and treatment, of chronic obstructive pulmonary disease. Zeng et al. (2017) conducted a

systematic review on the functional food components that play a key role in modifying the major risk factors for chronic diseases. Risso-Gill et al. (2015) uncovered major patient-related barriers to the detection and control of hypertension, which provides a potential means for designing and implementing hypertension management. Mukakalisa et al. (2014) highlight a method for screening and education for cervical cancer to prevent the disease in a developing country. Tibazarwa and Damasceno (2014) suggest several important alternatives for hypertension control in developing countries; using primary healthcare, having well-trained nurses for diagnosis and follow-up, and adopting a global cardiovascular risk approach for treatment purposes. Ebrahim et al. (2013) discuss the overall scenario of chronic diseases, emphasising the need for using research to understand the phenomena, and analyse and make use of it for prevention. Panieri (2012) suggests that a reasonable approach for cancer care is a screening program, which educates the population about the importance and benefits of early detection.

There are a number of preventive care concepts proposed in previous studies (refer to Appendix 1, which lists the articles that provide preventive care definitions), with some researchers viewing preventive care on the basis of the population (Gordon 1983), physician philosophies (Rebelsky et al. 1996), specific preventive care processes (Bartlem et al. 2016; Carpio et al. 2003; Glasgow, Orleans & Wagner 2001; McMorrow, Kenney & Goin 2014; Ogden, Richards & Shenson 2012; Sabbath et al. 2018; Solberg, Kottke & Brekke 1998; Solberg et al. 1997; Solberg et al. 1998) with levels of priority (Solberg et al. 1996) and preventive care categories (Bousquet et al. 2011; Cabral & Cullen 2017; Hoeck et al. 2014; Jusot, Or & Sirven 2012; Kenkel 2000; Tian, Chen & Liu 2010; WHO 2004, 2007).

Gordon describes preventive care based on population, resulting in three classifications:

Universal measures are recommended for essentially everyone. Selective measures are advisable for population subgroups distinguished by age, sex, occupation, or other evident characteristics, but who, on individual examination, are perfectly well. Indicated measures are those that should be applied only in the presence of a demonstrable condition that identifies the individual as being at higher than average risk for the future development of a disease. (Gordon 1983, p.109)

Rebelsky et al. (1996) reveal that preventive care is based on physicians' philosophies – a request-only focus requires the physician to respond to specific patient inquiries about prevention but taking no initiative to recommend indicated services, a health-maintenance visit requires the physician to provide indicated services only during visits specifically scheduled for preventive care, and an opportunistic-prevention focus requires the physician to provide the indicated preventive services at every chance.

Preventive care is also viewed from process aspects. The earlier work of Solberg and colleagues focussed on 'processes' (Solberg et al. 1996, p. 262). They explain that preventive care is grouped into 10 sub-processes consisting of guidelines, screening, status summary, follow-up, reminders, resources, counselling, outreach, prevention visit and patient activation. These sub-processes are divided according to levels of priority, those that are essential, important and useful. According to them, the level of priority helps to categorise the preventive care sub-processes systematically and may facilitate leaders and staff of each individual clinic to conduct a different process as outlined, thus leading to the best possible preventive care outcome.

The Solberg et al. (1997) study provides an image of a jigsaw puzzle to describe preventive care. Preventive care is illustrated as 'both the forest (whole system picture) and the trees (individual process pieces)' (p. 273), which includes the processes of screen, follow-up, track or recall, summarise, resource, patient activation, cue, counselling and prevention visit with guidelines as the main foundation. Solberg and colleagues developed the preventive care concept in the form of a jigsaw puzzle to facilitate the understanding of healthcare practitioners about preventive care and to plan for improvement. Further work by Solberg, Kottke and Brekke (1998) and Solberg et al. (1998) uses the same preventive care definition suggested by Solberg and colleagues in 1996, which refers to the 'processes' (Solberg et al. 1996, p. 262).

However, other studies that define preventive care based on sub-processes narrow the definition into a number of very specific sub-processes. For example, Glasgow, Orleans and Wagner (2001) view preventive care as one effort to identify the care system for clinical preventive care service by describing each component, such as screening and summarising of preventive needs. Carpiano et al. (2003) state preventive care includes processes such as screening, counselling and immunisation. Ogden, Richards and Shenson (2012) view preventive care as services that 'include

immunisations, disease screening, and behavioral counselling interventions' (p. 419). McMorrow, Kenney and Goin (2014) define preventive care as the management of diseases that includes appropriate screening, diagnosis and treatment of chronic diseases. Bartlem et al. (2016) view preventive care from three elements of care – assessment, brief advice and referral.

Some researchers describe preventive care based on several categories. Some studies view preventive care from two categories, and others describe preventive care from three or four categories. Two studies explain preventive care from two categories, in which primary service focuses on the prevention of disease, for instance, immunisation, and secondary service refers to early detection and diagnosis to prevent health problems (Hoeck et al. 2014; Tian, Chen & Liu 2010).

Kenkel (2000) views preventive care from three categories: primary, secondary and tertiary. According to Kenkel (p.1677), 'primary prevention consists of actions that reduce the occurrence or incidence of disease', for example, vaccinations, public sanitation and regular exercise, while 'secondary prevention consists of actions that reduce or eliminate the health consequences of a disease given its occurrence' (p.1677). Some examples of secondary prevention include screening for chronic illnesses for early detection and treatment that may lead to better outcomes. 'Tertiary prevention consists of actions that reduce disability associated with a chronic illness' (p.1677), such as providing education for diabetic patients on foot care to prevent complications.

WHO (2004) defines preventive care in four categories. Three categories, primary, secondary and tertiary, are quite similar to Kenkel's (2000) preventive care definition. However, WHO lists another category, known as primordial prevention, that refers to 'actions and measures that inhibit the emergence and establishment of environmental, economic, social and behavioural conditions, cultural patterns of living, etc., known to increase the risk of disease' (p. 46). Subsequently, WHO (2007) kept its 2004 definition.

Other studies use the preventive care definitions suggested by Kenkel (2000) and WHO (2004, 2007), such as Bousquet et al. (2011), who use the definition by WHO

(2007), while Emanuel (2012), Jusot, Or and Sirven (2012), and Cabral and Cullen (2017) use Kenkel's definition.

The literature thus shows that preventive care definitions mostly focus on administrative efficiency issues (Adonis et al. 2016; Hill et al. 2013; Krist et al. 2013) and do not include other important aspects. Administrative efficiency refers to the way healthcare organisations manage their services, such as administering an immunisation, ordering a test, counselling a patient or prescribing a medication (Krist et al. 2013). Administrative efficiency is important in preventive care because it enables healthcare organisations to administer and provide necessary services to chronic disease patients that are identified as in need of preventive care (Krist et al. 2013).

However, other than administrative efficiency, three important aspects have been identified for inclusion in the preventive care definition for this research – quality of care, health promotion and cost effectiveness. Quality of care for patients is important and should be provided immediately after the patient receives vaccination, screening or counselling (Krist et al. 2013), so they can access other preventive care services to improve their health quality. Martin et al. (2014) found that low quality of care may cause risks for patients with chronic diseases. For example, Lee, Chiang and Liu (2018) found three potential quality-improvement targets are important to facilitate the quality of colorectal screening completion. They emphasise that a lack of quality of care can contribute to low colorectal screening rates and a delay in diagnostic colonoscopy referrals. Thus, quality of care has been given greater attention because of its importance in identifying or detecting early chronic disease symptoms while reducing the risk of these diseases (Manuti et al. 2010). Despite its importance, the quality of care aspect is often not performed properly (Azam et al. 2010). For example, their study in a developing country found that even low-cost services such as patient education and foot examinations were not appropriately delivered, resulting in poor quality of care. Thus, there is a need to emphasise and include quality of care aspects in preventive care (Manuti et al. 2010). Therefore, in this research, the definition of quality of care is 'whether individuals can access the health structures and processes of care, which they need and whether the care received is effective' (Campbell, Roland & Buetow 2000, p.1614).

The term *health promotion* is sometimes viewed as a different concept from preventive care (Nutbeam 1998). Nutbeam (1998, p. 351) defines health promotion as ‘the process of enabling people to increase control over the determinants of health and thereby improve their health’. Moreover, he refers to prevention as having three levels – primary, secondary and tertiary prevention – where primary prevention deals with preventing the initial occurrence of a disorder. Secondary and tertiary prevention focus on ‘arresting or retarding existing disease and its effects through early detection and appropriate treatment; or to reduce the occurrence of relapses and the establishment of chronic conditions’ (Nutbeam 1998, p. 353). Similarly, Tengland (2010) addresses health promotion as a different concept from prevention, referring to it as a participatory approach, with preventive care being a top-down approach. In contrast, other researchers include health promotion as one aspect of preventive care (Golechha 2016; Gullotta & Bloom 2003; Valdez et al. 2010). Studies attempting to match health promotion place it in primary prevention (Bowler & Gooding 1995; Gullotta & Bloom 2003). Moreover, previous studies argue that health promotion is not only a concept that concerns an absence of disease related to health education through information giving, advice, support and skills training, but also should consider the ability to cope with illness and disease (Maben & Clark 1995). Thus, there is no conclusive definition for health promotion.

Despite different views on the health-promotion concept, studies have found that the effectiveness of various health-promotion methods in primary prevention are lacking among those who are unaware of chronic diseases (Golechha 2016). This is because the level and quality of health-promotion activity in primary care are variable, with many patients not receiving interventions (Bowler & Gooding 1995). For example, Tam, Lo and Tsui (2018) found that patients who have a lack of knowledge about preventive care, and do not seek preventive care advice from doctors, receive restricted preventive care, thus contributing to a lack of awareness and low uptake of preventive care services. Therefore, it is essential to include this aspect in preventive care because it concerns activities that can increase knowledge and create awareness among the population that can delay the onset of chronic disease (Huang et al. 2011; Srinivas & Paphitis 2016). Thus, in this research, health promotion refers to a range of activities with the purpose of improving the health of individuals, groups and communities through general measures such as health education, health

communication (advertisements) and social activities (social support groups) (Gullotta & Bloom 2003).

Cost effectiveness has become another important aspect in preventive care due to increasing constraints in healthcare funding (Chokshi & Farley 2012; Davari, Kilic & Naderi 2016; Meenan et al. 2015). Therefore, it is important to include cost effectiveness in preventive care to understand the influence of treatment cost on health outcomes (Meenan et al. 2015). For example, Singh et al. (2018) found that preventive care services such as pedometer interventions, advice and counselling on physical activity and action-planning interventions are the most cost-effective strategies to increase physical activity in primary care. Research by Muller et al. (2018) found that women with the breast cancer genes BRCA1/2 who underwent surgical prevention options led to potential cost savings and better quality of life compared to no surgical prevention. Therefore, in this research, cost effectiveness is defined as the value between treatment costs and health outcome (Probstfield 2003).

In summary, this research considers multiple aspects of preventive care for chronic diseases – administrative efficiency, quality of care, health promotion and cost effectiveness. Using these aspects allowed me to investigate the influence of IS resources on preventive care performance from a comprehensive perspective of preventive care. Thus, in this research, preventive care refers to the healthcare service that creates the population's awareness through health promotion, improves patient health through administrative efficiency, and provides better quality of patient care that is cost effective. Section 2.5.5 further discusses the influence of IS resources on these four aspects of preventive care in relation to HIS.

2.4 The health-system model for chronic diseases in developed and developing countries

The management of chronic illnesses can actually be improved by implementing two concepts – preventive care (as discussed above) and chronic disease management (CDM) (Glasgow, Orleans & Wagner 2001). In developed countries, CDM is adopted to improve chronic illnesses (Norris et al. 2003; Wagner 2000; Zuccaro 2015). CDM is a patient-centred approach to healthcare delivery that emphasises a systematic approach, is proactive and provides longitudinal care between visits (Norris et al. 2003;

Wigg et al. 2015). Implementing chronic disease care requires collaboration across healthcare sectors and a professional practice team within healthcare (Cheah 2001).

One of the most successful CDM models in developed countries is the chronic care model (CCM) developed by Wagner and colleagues (Wagner 1998; Wagner 2000; Wagner et al. 2001; Wagner Austen & Kauff 1996). The CCM is rooted in North American healthcare, where this framework has successfully guided a number of American healthcare practices for chronic conditions (Epping-Jordan et al. 2004; Wagner 2000). The CCM is a patient-centred approach, emphasising patient-practitioner interaction that considers the patient as the main actor in the management of their disease, setting their own treatment targets and collaborating with a multidisciplinary professional healthcare team (Wagner 2000). In addition, adopting CCM involves practice teams that consist of a range of professionals, such as medical specialists, nurse case managers, clinical pharmacists and social workers (Wagner 2000). This model describes some elements in the healthcare system that require comprehensive system changes to address chronic diseases (Wagner et al. 2001), particularly those in primary-care settings (Epping-Jordan et al. 2004; Wagner 1998). The CCM consists of six components of a practice system – organisation of care, clinical IS, delivery system design, decision support, self-management support and community resources (Glasgow, Orleans & Wagner 2001).

In developing countries, however, the health model to address chronic illness is more in line with preventive care concepts. The preventive care framework is proposed by Solberg and colleagues, particularly in the primary-care setting (Solberg et al. 1997, 1998). In developing countries, healthcare services commonly use preventive care intervention within acute care orientation to respond to chronic diseases (WHO 2005). Therefore, a preventive care service is likely to follow acute illness model characteristics. First, the acute illness care model provides an individually-oriented diagnosis, curative actions with their effectiveness largely depending on time-sensitive (short-term episodic) illness and, frequently, rapid intervention with the purpose of improving health (Hirshon et al. 2013). Second, in this care model, patients with short-term illness are separated from the public and are provided with treatment in healthcare organisations (Yasin et al. 2012). Therefore, using preventive care within acute illness disease models to manage long-term and continuous illness of chronic

diseases in developing countries might be challenging because the focus is more towards care of short-term illnesses, and is symptom driven (Ramli & Taher 2008, Wigg et al. 2015; Yasin et al. 2012). Furthermore, healthcare organisations must focus on two types of diseases; communicable and chronic, requiring them to stretch their resources. Moreover, changing the existing health system to address the epidemic of chronic diseases requires enormous effort across healthcare sectors and needs an adequate budget, especially if healthcare models for chronic diseases from developed countries are to be adopted by developing countries (Yasin et al. 2012).

There are other reasons why preventive care within the acute care model is applied in most developing countries rather than adopting CDM. First, the CDM concept has yet to penetrate most developing countries because it is new locally, having its origins in developed countries (Cheah 2001; Yasin et al. 2012). Second, the application and interventions of the CDM concept are new to acute diseases and the preventive care area (Norris et al. 2003). Therefore, there is little understanding among healthcare practitioners about the concept of this framework (Cheah 2001). Third, effective management of chronic diseases requires coordination of care and a focus on patient-centred service for a period of time and across disciplines (Dejesus et al. 2012; Mahomed, Asmall & Freeman 2014). Existing care delivery in developing countries has mostly not addressed these issues, thus it becomes a challenge to adopt this new care concept (Cheah 2001). Fourth, developing countries face resource constraints and stretch in human capital, thus do not allow for changes in their care delivery system to a comprehensive CDM concept (Yasin et al. 2012). Hence, if the CDM concept is to be implemented by developing countries, healthcare organisations need to have the required human and infrastructure resources and fully integrated IT operating within an integrated care delivery system (Mahomed, Asmall & Freeman 2014; Yasin et al. 2012; Zuccaro 2015). Fifth, the financing models (Yasin et al. 2012), particularly incentives provided for public healthcare to ensure patient-centred care is achieved and coordinated across the health services (Cheah 2001), need to be strengthened if the CDM concept is to be applied to address chronic diseases in developing countries. Given that the preventive care model dominates the healthcare system in most developing countries (WHO 2005), this research focused on preventive care intervention within the acute care orientation (WHO 2005).

Preventive care frameworks have been proposed by Solberg and colleagues (Solberg et al. 1997; 1998). Generally, preventive care is initiated by primary healthcare facilities and supported by good referral systems (Dans et al. 2011), delivered by doctors, specialists, pharmacists and nurses (Vedel et al. 2012). Preventive care has three levels in managing chronic diseases – primary (Kruk, Nigenda & Knaul 2015), secondary (Borja-Aburto et al. 2016; Nissine, Berrios & Puska 2001) and tertiary (Aikins, Boynton & Atanga 2010; Alleyne et al. 2013; Joseph et al. 2006; Lahariya et al. 2014; Nohara et al. 2015; Some et al. 2016). Solberg et al. (1997) present 10 components of preventive care processes:

1. Guidelines – a clinic-wide written policy that has been specifically accepted by all clinicians as a common approach to prevention services.
2. Screening – a routine way to identify the prevention needs of patients as they are seen in the clinic.
3. Status summary – a medical chart flow sheet summarising the data of all prevention services or data on risk factor changes.
4. Follow-up – a routine, timely way to inform patients of test results, to reinforce behaviour changes, and to re-involve patients who do not return.
5. Reminder – a routine way to remind clinic staff or clinicians that a particular patient may be in need of something for a preventive service.
6. Resources – education or referral information for patient or healthcare personnel organised to be readily available when needed.
7. Counselling – a non-physician can provide patients with information and problem-solving assistance beyond brief advice.
8. Outreach – an organised way to offer preventive services to non-patients or to involve a patient's family members in the patient's care.
9. Prevention visit – an office visit designed primarily to identify and address prevention issues, either alone or as part of a check-up.
10. Patient activation – an activity that informs patients of the clinic's prevention guidelines while encouraging them to actively stay up-to-date.

2.4.1 Similarities between preventive care and the chronic care model

Previous studies have found many similarities between preventive care and chronic care frameworks (Glasgow, Orleans & Wagner 2001), as presented in Table 2.4. For

example, Glasgow, Orleans and Wagner (2001) found that the goals of CDM are preventive in orientation, and the nature of CCM is aligned to the 10 components of preventive care processes (Wagner 1998). Moreover, Glasgow, Orleans and Wagner (2001) view the CCM and preventive care model as complementary. Preventive care describes specific elements of preventive care processes while the CCM indicates the characteristics of the practice systems to address the chronic conditions (Glasgow, Orleans & Wagner 2001). For example, a specific element of preventive care processes, screening, requires the key system concept of teamwork. Therefore, it is likely that many of the CCM elements are applied in preventive care (Glasgow, Orleans & Wagner 2001) to address chronic diseases.

Table 2.4: Similarities between preventive care and the chronic care model (Glasgow, Orleans & Wagner 2001)

Aspects	Description
Goals	Both have goals that are preventive in orientation.
Screening and counselling involvement	Both involve regular screening and counselling for health behaviour change to prevent disease.
Identification for a defined population of patients	Both require being able to identify a defined population of patients.
Planned care and follow-up	Both are complex, require addressing multiple health behaviour change or risk factors.
Patient involvement	Both require active patient involvement in adherence to complex screening, behaviour change or treatment regimes.
Trained healthcare practitioners	Practitioners are inadequately trained for their roles in both.
Community resources	Both need a connection to community resources outside healthcare settings.
Cost effective	Policymaker/decision-maker fears that both are costly and may not be cost effective.

Although there are similarities between the two concepts, in this research, I set out to gain a better understanding of the preventive care concept applied in developing countries, including Malaysia. Thus, this research explored preventive care, and not the CCM, in the context of a Malaysian case.

2.4.2 Southeast Asia health-system review

This section presents an overview of the health system in Southeast Asia, as this region is experiencing a huge increase in chronic diseases (Mannava et al. 2015).

Southeast Asia consists of the 10 independent countries of Brunei, Singapore, Malaysia, Thailand, the Philippines, Indonesia, Vietnam, Laos, Cambodia and Myanmar collectively known as the Association of Southeast Asian Nations (ASEAN) (Chongsuvivatwong et al. 2011). In ASEAN, health services have become an important industry, with a mix of public and private non-profit and for-profit actors, along with the growth of trade and medical tourism.

Rapid economic development across the ASEAN countries has led to hugely increased access to healthcare, yet coverage across the region remains uneven. For example, Singapore offers a world-class health system while poorer neighbours such as Indonesia and Vietnam struggle to provide even the most basic coverage within their financial budget. Moreover, in countries like Singapore and Malaysia, the healthcare systems are changing from government-dominated health services towards greater private-sector involvement (Chongsuvivatwong et al. 2011). However, in Malaysia, the public healthcare system is still the major part of the country's healthcare sector serving the majority of the population (MOH Malaysia 2012).

Furthermore, most health systems in many developing countries in the ASEAN region share features, such as having primary-care services with referral to secondary and tertiary care (Ang et al. 2014; Samb et al. 2010). However, these countries have fragile health systems that are under-resourced. For example, in Malaysia, there is an uneven distribution of primary-care health services and resources between public and private sectors, and between rural and urban areas in terms of basic facilities and devices for maternal and preventive services, the skill-mix of healthcare practitioners, and experience, clinic workload and availability of health services and resources (Lim et al. 2017). Indonesia's healthcare organisations experience inadequate infrastructure and application; there is no formalised IT planning and related policy, the structure of the roles and responsibilities of IT is still not well defined, and there is a lack of IT competence in staff (Handayani, Rahman & Hidayanto 2013). In Vietnam, the number of nurses increased considerably between 2006 and 2013 (Nguyen, Mirsoev & Le 2016). However, the number of pharmacists slightly decreased between 2011 and 2013 (Nguyen, Mirszoev & Le 2016). In Malaysia, specialist resources are very limited, especially in the public sector, with 0.9 specialists per 1,000 population compared to three to five specialists per 1,000 for some developed countries (Ang et al. 2014).

These countries also face difficulties in preventing chronic diseases due to the rapid increase in disease incidence and inadequate health-system preparation for these increases (Lim et al. 2014; Mannava et al. 2015). In Thailand, there is uneven coverage of specialist services between rural and urban hospitals. Moreover, laboratory testing and preventive care screening are not performed regularly (Goldhaber-Fiebert et al. 2010). In Malaysia, chronic disease screening is infrequent. Patients with diabetes mellitus can receive routine preventive care treatment at Malaysian Government-owned primary health clinics without cost, and treatment for complications at government hospitals at minimal cost (Goldhaber-Fiebert et al. 2010).

Providing access to quality preventive care of chronic diseases could be challenging for countries with limited resource settings. However, healthcare organisations in developing countries still play a major role in providing preventive care services. For instance, in Vietnam, early detection of breast cancer through the national screening program could result in substantial improvements in the survival rate of patients in low- and middle-income countries, while the treatment of breast cancer is still limited (Nguyen & Adang 2018). Furthermore, a sustainable community-based intervention using a story-telling method for public health education has been developed to promote engagement in the process of detecting and treating hypertension in Vietnam (Allison et al. 2016). In Indonesia, an effort has been made to address cardiovascular disease, such as organising health-promotion programs that accommodate local demands (Dewi et al. 2013). The program is called Program to Reduce Cardiovascular Disease, and its purpose is to increase awareness of the dangers of cardiovascular disease and encourage people to change health behaviours (Dewi et al. 2013).

In summary, an overview of health systems in many countries in the ASEAN region, including Malaysia, shows they are characterised by inadequate financial resources, shortages in health workers, unsuitable service-delivery models and weak health IS (Mannava et al. 2015). This means that Malaysia presents an interesting case study for this research.

2.4.3 *The Malaysian health system*

This section focuses on the Malaysian health system because Malaysia is selected as a case study for this research. Malaysian healthcare delivery services are provided by

a dual system involving the public and private sectors (Tenth Malaysia Plan 2011–2015). Despite the dual health system, the government remains the main policymaking and regulatory body (Tenth Malaysia Plan 2011–2015). The Malaysian health system is mainly publicly funded, and has been successful at a moderate cost in dealing with public health services, ranging from health promotion and illness prevention to curative and rehabilitative care (Jaafar et al. 2013; Thomas, Beh & Nordin 2011). These services are delivered at primary, secondary and tertiary levels of care. The Malaysian public system caters for the healthcare needs of the majority of the population in addressing the epidemiological transition of the double burden of infectious diseases and recently faced challenges of chronic diseases (Jaafar et al. 2013). For this reason, this research focused on a public hospital in Malaysia.

The process of patient care in the Malaysian public health system starts with health clinics. Patients usually go through a process of registration, pre-consultation, risk-investigation consultation, diagnostic tests, diagnosis and intervention (Jaafar et al. 2013). Doctors, with support from other staff, may treat patients, follow-up later to check their condition, or refer them to hospitals for secondary and tertiary treatment (Jaafar et al. 2013). However, in Malaysia, the MOH has an ‘open door’ policy for outpatient services and hospital admissions. Patients can bypass primary-care clinics or health clinics and go directly to hospital outpatient care and pay the small charge imposed for walk-in patients (although for many these charges are waived) (Jaafar et al. 2013).

In terms of health technology, one of the biggest achievements in the Malaysian health sector is the use of HIS in public healthcare (Hassan 2012; Zakaria & Yusof 2016). Generally, HIS use has enabled healthcare practitioners to improve the quality of care and makes healthcare more cost effective (Amin, Hussein & Isa 2011; Murphy & Neven 2014). By using HIS, public healthcare efficiently delivers its services to patients. For example, HIS provides accurate and complete information about a patient’s health so the healthcare practitioner can give the best possible care, whether during a routine visit or a medical emergency (Yang et al. 2015). Most importantly, utilisation of HIS enables healthcare practitioners to coordinate the care provided, especially to patients who have a chronic disease and serious medical conditions (Ahmad & Tsang 2013). Moreover, the use of HIS makes it possible for healthcare

practitioners to focus on preventive care by securely sharing information with patients and their caregivers (Asan et al. 2015; Czaja 2016). Thus, patients and their families can participate in decisions about the patient's healthcare (Czaja 2016). Likewise, healthcare practitioners have the ability to share the information to help diagnose health problems, reduce medical errors and provide safer care at lower costs (Li et al. 2012). Section 2.5 further discusses details of HIS; specifically, Section 2.5.5 provides an overview of HIS in Malaysia.

2.4.4 *Malaysian preventive care service*

To overcome the growing incidence of chronic diseases, as mentioned in Section 2.2, the Government of Malaysia includes a range of services from the public system, from primary-care clinics to tertiary care centres (Yasin et al. 2012). The primary healthcare facilities within a typical district would consist of a district hospital and a number of large primary-care clinics or health clinics, *Klinik Kesihatan* (Yasin et al. 2012). These clinics provide ambulatory primary care for acute medical and surgical, maternal and child health, and also the management of chronic diseases (Yasin et al. 2012). Thus, health clinics provide treatment for both communicable diseases and primary prevention of chronic diseases (wellness programs such as a diabetes program, early detection of cancer, screening for cardiovascular risk factors for women aged above 40 years, as well as a tobacco-cessation program) (Yasin et al. 2012). However, because the Malaysian public health system has a strong focus on communicable disease surveillance and control, and on maternal and child health, especially in primary care (Yasin et al. 2012), capacity for the prevention of chronic diseases is limited.

Thus, the secondary and tertiary prevention of chronic diseases (early identification and treatment, disease and disability limitation, rehabilitation and palliative care) are provided by specialty and sub-specialty services (Medical Development Division 2011). In the Tenth Malaysia Plan 2011–2015, the government continued to upgrade and expand its health facilities across both urban and rural areas. It specifies strengthening and consolidating provision of secondary and tertiary care services, and further extending primary-care services to underserved areas. Moreover, the plan states that the government has put its effort into moving towards wellness and disease prevention. This is because Malaysia faces higher incidences of chronic conditions

such as diabetes, hypertension and cardiovascular diseases. For example, as reported in Tenth Malaysia Plan 2011–2015, from 1996 to 2006, Malaysia saw a dramatic increase in the prevalence of behaviour-linked diseases, including a 43% increase in hypertension, 88% increase in diabetes and 250% increase in obesity (Tenth Malaysia Plan 2011–2015), as shown in Figure 2.2.

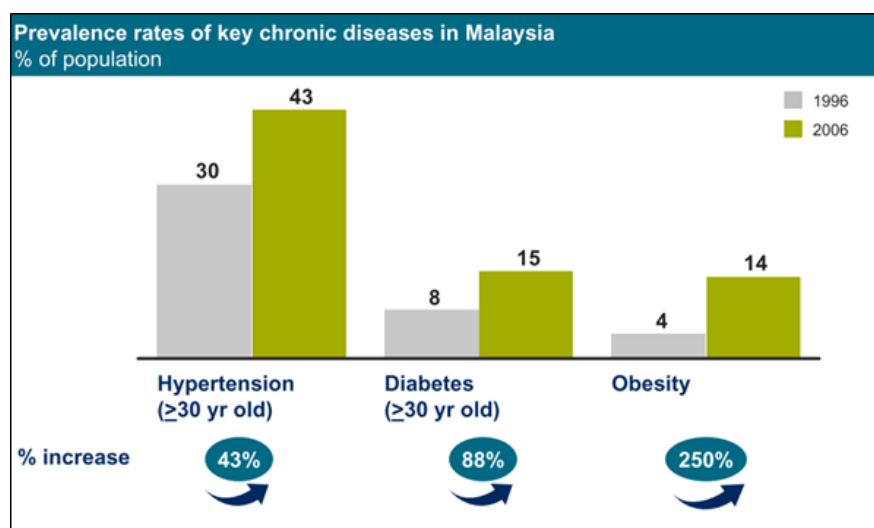


Figure 2.2: Prevalence rates of key chronic diseases in Malaysia (Tenth Malaysia Plan 2011–2015)

Moreover, as stated in the Eleventh Malaysia Plan 2016–2020 (Economic Planning Unit 2015) and Country Health Plan, 2011–2015 (MOH Malaysia 2011), one of the basic principles of future healthcare delivery that may ensure a healthy population and reduction in cost for curative care is the preventive care that has become a focus for the health sector in the country. The effort for preventive care is documented in the Country Health Plan, 2011 (MOH Malaysia 2011).

Furthermore, the Malaysian Government developed the 10-year NSP-NCD for 2010–2014, and recently NCP-NCD for 2016–2025 to improve the health status of the population, expanding the scope of chronic disease prevention and control while maintaining current preventive activities (MOH Malaysia 2010, 2016). Table 2.5 outlines the chronic disease national targets for Malaysia by 2025 (MOH Malaysia 2016).

Table 2.5: Chronic disease targets for Malaysia 2025 (Ministry of Health Malaysia 2016)

Indicator		Global target	Malaysian baseline	Target (2025)
1.	Risk of premature mortality from cardiovascular diseases, cancer, diabetes, or chronic respiratory diseases	25% relative reduction	20%	15%
2.	Prevalence of current tobacco use in a person aged 15+ years	30% relative reduction	23%	15%
3.	Mean population intake of sodium	30% relative reduction	8.7 grams	6 grams
4.	Prevalence of insufficient physical activity	10% relative reduction	35.2%	30.0%
5.	Harmful use of alcohol (prevalence of heavy episodic drinking)	10% relative reduction	≤1.2%	≤1.2%
6.	Prevalence of raised blood pressure	25% relative reduction	32.2%	26.0%
7.	Prevalence of diabetes and obesity	Halt the rise	≤15%	≤15%

Thus, the role of prevention and control of chronic diseases in reducing morbidity and mortality is crucial in Malaysia. Chronic diseases, which include heart disease, stroke, diabetes, cancer, mental illness and chronic respiratory disease, present a huge challenge in the next few decades, globally as well as for Malaysia (MOH 2011).

Based on the above issues, the Malaysian Government has invested effort towards preventive care, with such effort reflected in the objectives of the development of the Specialty and Subspecialty Framework for 10MP (Medical Development Division 2011). There are a few general objectives of the framework. First, to provide adequate and effective specialty and sub-specialty services for the secondary and tertiary prevention of diseases (early identification and treatment, disease and disability limitation, rehabilitation and palliative care). Second, to improve access to specialty and sub-specialty services appropriate to the needs and resources available. Third, to improve the delivery and quality of specialty and sub-specialty services. Fourth, to address rising costs as well as ensure efficient use of resources for specialty and sub-specialty services towards a sustainable health system. Fifth, to strengthen human capital planning and development with the right numbers, skill-mix and required competency towards sustainable specialty. Sixth, to adopt appropriate technology and new interventions for the management of diseases to improve the quality of specialty

and sub-specialty services towards better outcomes (Medical Development Division 2011). Nevertheless, these initiatives had little impact, and therefore, this research is focusing on preventive care.

2.5 The hospital information system

Previous studies suggest that the adoption of HIS can result in significant improvement in preventive care (Bauer et al. 2014b; Hameed et al. 2016; Jabbour et al. 2003; Nohara et al. 2015), and is crucial to improving the processes and outcomes in healthcare organisations (Ozok et al. 2014). For example, Ahmad and Tsang (2013) state that using HIS improves the process measure for diabetes. The patient registry feature could enable the identification of pre-diabetic patients, and patient progress could be tracked using weight-monitoring tools connected to the system. Moreover, HIS is used to capture body mass index as structured data to produce a list of obese patients. This helps patients engage in their own health and encourages them to benefit from preventive care (Ahmad & Tsang 2013). Moreover, Bauer et al. (2014b) highlight the use of HIS in helping improve the accessibility of patient records, convenience and increasing the quality of care, while at the same time helping reduce healthcare costs. Thus, the delivery of preventive care services can be effectively delivered when supported by HIS.

The adoption of HIS can be traced back as early as the 1960s (Borzekowski 2009). For example, hospitals in the United States of America began to adopt IT in the 1960s with the goal of improving operational quality and reducing costs (Borzekowski 2009). Based on his study, which uses eight years of data analysis from 1987 until 1994, Borzekowski (2009) found nearly 3,000 American hospitals with more than 100 beds had adopted a HIS. Globally, the adoption of HIS has been progressing across hospitals in North America, Europe, the Asia Pacific, Africa and the Middle East, as presented in Table 2.6.

Table 2.6: Adoption of hospital information systems globally

Region	Country/City
North America	USA (Peng, Dey & Lahiri 2014) USA (Adler-Milstein, Kvedar & Bates 2014) USA (Adler-Milstein & Bates 2010) USA (Ahmad & Tsang 2013) USA and Puerto Rico (Geanuracos et al. 2007) USA (Overhage, Grannis & McDonald 2008) New York (Howland et al. 2015) Canada (Zinszer et al. 2013) New York (Shih et al. 2011)
Europe	England (Warrick et al. 2011)
Asia Pacific	Australia and New Zealand (O'Sullivan, Billing & Stokes 2011) Japan (Yoshida, Imai & Ohe 2013) Nepal (Watkinson-Powell & Lee 2012) Malaysia (Amin, Hussein & Isa 2011; Ismail, Abdullah & Shamsuddin 2015; Lee, Ramayah & Zakaria 2012; Haque et al. 2013; Zakaria & Yusof 2016) Indonesia (Handayani, Rahman & Hidayanto 2013) Vietnam (Vu & Nguyen 2010)
Africa	Uganda (Were et al. 2010a) Kenya (Bernardi 2017; Oluoch et al. 2014)
Middle East	Iran (Ahmadian et al. 2014; Ehteshami et al. 2013; Hosseini et al. 2014; Moghaddasi et al. 2018)

2.5.1 Hospital information system definition

Table 2.7 presents various HIS definitions provided by researchers, showing an evolution of the definition. In 2009, HIS was defined as a system that collects and disseminates data systematically. From 2011 to 2018, it was viewed more as an integrated system rather than just having a recording function. In this research, HIS is defined as an integrated system that manages the overall hospital operations and administration to improve healthcare service delivery and minimise healthcare costs.

Table 2.7: Hospital information system definitions

Author	Definition
Borzekowski (2009)	A technology that improves the information that would be a useful tool in gathering, storage, transmission and processing of hospital management.
Vital Wave Consulting (2009)	Any organised effort to systematically collect, maintain and disseminate data relevant to the performance of a health system or any of its component parts.
Amin, Hussein and Isa (2011)	A massive, integrated system that supports the comprehensive information requirements of hospitals, including patient, clinical, ancillary and financial management.
Handayani, Rahman and Hidayanto (2013)	An integrated information system to handle the entire process of hospital management starting from the registration process, medical and medicine services, as well as its internal services such as employee data management, finance and procurement.
Ahmadi, Nilashi and Ibrahim (2015)	A comprehensive, integrated information system designed to manage the administrative, financial and clinical aspects of a hospital.
Ismail, Abdullah and Shamsuddin (2015)	An integrated electronic system that collects, stores, retrieves and displays overall patient data and information, such as the history of the patient, results of laboratory tests, diagnoses, billing and other related hospital procedures that are used in several departments within the hospital.
Bernardi (2017)	Provides health information that can ideally allow healthcare managers and practitioners to plan and monitor health services, which may translate into better health outcomes.
Askar, Ardakani and Majdzade (2017)	A comprehensive, integrated system that provides information to support the decision-making process with relevant evidence, and thus ultimately contribute to improving health status.
Lee and Lee (2018)	A tool to improve communication among practitioners within and between organisations by automating the collection, use and storage of patient information.

2.5.2 Type of hospital information systems

HIS has various meanings according to different researchers. The term used in previous studies depends on the functions, stakeholders, context or theoretical framework (Angst et al. 2011). A growing body of research related to HIS adoption discusses the different types of technology used in healthcare organisations. The term *hospital information system* can include a wide range of technology (Hameed et al. 2016), which can be general, such as a management IS (Chen & Cheng 2008), or can be specific, such as an electronic health record (EHR) (Moerenhout, Devisch & Cornelis 2018), clinical IS (Mahmudul et al. 2013), computerised decision-support systems (Moja et al. 2014) or computerised order-entry system (Murray-Weir et al. 2014).

In the healthcare context, IT is usually referred to as *health information technology* (HIT) (Angst et al. 2011; Lacson et al. 2018) and sometimes IS is referred to as *health information system* (Gambo, Soriyan & Ikono 2014; Moghaddasi et al. 2018). For instance, in previous research, HIT has sometimes been used to refer to the HIS concept (Yang et al. 2015; Peng, Dey & Lahiri 2014). Therefore, in this research, HIS is used to describe the same concepts as HIT. Refer to Appendix 2 for the type of HIS technology used in different countries and its adoption globally, such as in North America, Europe, the Asia Pacific, Africa and the Middle East.

2.5.3 Benefits of a hospital information system

The increasing demand for quality healthcare services from the community has been a challenge to healthcare organisations, and especially to hospital management (Brunt & Bowblis 2014; Kitsantas, Moncada & Abdul 2016; Lee, Chiang & Liu 2018; Lee & Meuter 2010). Nowadays, people are very selective and demanding of the quality of healthcare services, especially in their treatment, diagnosis, and quick and accurate results. As demand increases, the government and healthcare organisations have to find a solution, which is adopting HIS to overcome the issues (Ahmadi, Nilashi & Ibrahim 2015; Lai, Lin & Tseng 2014). Hosseini et al. (2014) state that HIS adoption can improve the quality of services by expediting healthcare services. Moreover, Devaraj, Ow and Kohli (2013) found that using HIS in healthcare can increase overall hospital performance. Table 2.8 demonstrates the benefits of using a HIS and its impact, organised on the Kruk and Freedman (2008) health-system performance framework. There are three categories of impact in the framework – effectiveness, equity and efficiency. The framework describes the impact on hospital performance.

Table 2.8: Hospital information system benefits

Author	Benefits of hospital information system	Impact on performance
Tai and McLellan (2012)	Provide standardise and accessible information for care team	Equity
Mishuris and Linder (2014)	EHR and preventive care reminders were equally used across racial and ethnic groups of patients	Equity
Weiner, Yeh and Blumenthal (2013)	Address regional shortages of physicians	Efficiency
Hosseini et al. (2014)	Reduce hospital cost by reducing the amount of paper consumption, omitting several stages of hospital procedures	Efficiency
Lee, Wan and Kwon (2012)	Decrease the cost of organisation. In terms of the total cost in hospital, the adoption of hospital information system application may lead to reduction in the total expense in hospital	Efficiency-cost and productivity
Moody-Thomas et al. (2015)	Data produced from the system is used for clinical treatment	Effectiveness-access-availability/ utilisation
	Improve the quality of services in the hospital by increasing the speed of services	Effectiveness – access
Oluoch et al. (2014)	Improve the quality of care with the placement of the system	Effectiveness – access – availability
	Better compliance with clinical guidelines	Effectiveness – quality – safety
O'Sullivan, Billing and Stokes (2011)	Medical information was accurate and understandable, confidentiality or not having enough information at hand regarding test results, the ability to access records from multiple clinic locations	Effectiveness- access-availability
	Ability to easily access client medical notes and test results	Effectiveness-quality of care
	Automatically generate reports to referring doctors, avoids the logistical headaches of legal recordkeeping requirements	Efficiency-administrative
	Allow user queries to be flexible and can retrieve and sort information in a myriad of ways or views without needing to read everything chronologically to get the big picture	Efficiency-productivity
Monsted (2018)	Data produced is used to support specific care activities, detect exacerbation on chronic disease condition	Effectiveness-access-availability/ utilisation

Note: EHR = electronic health record

2.5.4 Hospital information system in resolving preventive care

Before discussing the studies of the impact of HIS on preventive care performance and the limitations to these studies, the following describes how these studies were selected, with the analysis presented in Table 2.9.

In this research, I conducted a search on HIS in relation to preventive care, following the search methodology of other standard systematic reviews accepted in the healthcare setting (McElwaine et al. 2016; Surchkre, Boluarte & Niessen 2012). The purpose of conducting this review was to produce a summary analysis of past studies from 2006 to 2018 of studies reporting the impact of HIS on preventive care performance (refer Table 2.9).

First, databases such as Web of Science, Science Direct, SpringerLink, Emerald, EBSCOhost and Scopus were used to search for peer-reviewed articles, editorials and conference proceedings (McElwaine et al. 2016). The search strategy consisted of free-text and terms searched using the Boolean operators for combinations of the following key words 'technology', 'e-health', 'health information technology', 'preventive care' and 'chronic diseases' (Mahmud & Aljunid 2018).

Second, the systematic literature search initially yielded almost 1,000 studies with abstracts. After the studies were screened for full text and duplicates removed, there were 386 candidate articles identified, of which I selected 128 for full text retrieval (see Appendix 3 for the flow diagram of inclusion and exclusion of studies on HIS impact on preventive care outcomes). I discarded 258 studies at this initial stage mainly because it was obvious that they violated basic inclusion criteria. The basic inclusion criteria include that the source is peer-reviewed, the paper is a journal article and is in English language from 2006 to 2018.

Third, following the first critical assessment, 66 articles were dropped from the 128 articles because they failed one or more inclusion criteria, resulting in 62 articles that were almost close to the criteria. Those articles dropped were those irrelevant to the topic of study, comprising oral preventive care (n = 22), dental prevention (n = 5), office prevention (n = 1), workers prevention (n = 2), mental prevention (n = 2) and injury prevention (n = 1) and others (n = 30).

Fourth, I selected a total of 40 articles for review after considering the most appropriate criteria for this research in the second critical assessment. The basic analysis of the 62 articles, including the final 40 articles, were extracted to a table (see Appendix 4A, with a summary of the analysis in Appendix 4B) about studies reporting the impact of HIS on preventive care and healthcare performance; the summary of the 40 articles are presented in Table 2.9. The literature search enabled me to gather information on the impact of HIS on preventive care of chronic disease outcomes, the analysis of which is discussed in the next paragraph.

Table 2.9: Summary of research analysis from 2006 to 2018

Number of studies: 40				
Main benefits of HIS on preventive care: Improved medication adherence, medication management, facilitate doctor-patient communication, promote positive health behaviours, improved documentation, facilitate diet assessment, reduce treatment cost, enhance patient treatment and monitoring				
Results:	Positive	Negative	Mix	Total
HIS impact on one preventive care performance:				
Quality of care	13	2	3	18
Cost effectiveness	2	-	-	2
Health promotion	2	-	1	3
Administrative efficiency	3	-	2	5
HIS impact on more than one preventive care performance:				
Quality of care and cost effectiveness	4	1	2	7
Quality of care and health promotion	1	-	-	1
Quality of care and administrative efficiency	2	-	1	3
Health promotion and administrative efficiency	1	-	-	1
Total	40			

Table 2.9 presents a summary of the main benefits of HIS on preventive care. Based on the review, many researchers outline the benefits of HIS on preventive care. Lacson et al. (2018), found that HIS use was associated with improved follow-up management of a patient with abnormalities suspicious of lung cancer. HIS has the potential to assist the healthcare practitioners through its ability to attach copies of finalised reports for follow-up testing and improve follow-up performance for a patient with pulmonary nodules who was likely to develop lung cancer.

Moreover, use of these technologies allows for obesity treatment, such as individualised treatment recommendations to be delivered to individuals remotely, increased self-monitoring or tracking of health-related data, broader and more rapid dissemination of health information or recommendations, and increased patient to dietician or physician contact (Carter et al. 2012). Misono et al. (2010), in their systematic review, found that using HIS can improve adherence to medications for cardiovascular disease and diabetes. Other studies found that EHR practices demonstrate higher achievements for diabetes care and better outcomes compared to the use of paper-based systems (Cebul 2011; Frimpong 2013). Vollmer and colleagues evaluated the effectiveness of technology-based tools, finding that the utilisation of HIS can improve adherence to chronic disease medications among patients with diabetes and measure cardiovascular disease risk factors (Vollmer et al. 2014). Thus, the available evidence from these studies shows that HIS is used to benefit preventive care.

Despite various positive outcomes on the effect of HIS on preventive care shown by previous studies, there are limitations. First, most studies on HIS and preventive care performance were carried out in developed countries, with only a few reported in developing countries.

Second, some studies evaluated HIS on healthcare performance in general (Black et al. 2011; Cho et al. 2013; Devaraj, Ow & Kohli, 2013; Gaylin et al. 2011; Ker et al. 2014; Kitsantas, Moncada & Abdul 2016; Nimkar 2016; Park & Lee 2014; Selck & Decker 2016; Yusof 2015) and some studies investigated specific preventive care performance, especially from administrative efficiency, quality of care, cost effectiveness and health-promotion aspects. However, most research on HIS has been on the quality of care performance. Therefore, there remains limited exploration of HIS in other preventive care areas such as cost effectiveness, health promotion and administrative efficiency, as highlighted in Table 2.9.

Third, the studies (refer to Table 2.9) report inconclusive results on the impact of HIS regarding quality of care, cost effectiveness, health promotion and administrative efficiency. For example, some research suggests that HIS use does not lead to improving quality of care. This issue was evident in a longitudinal study by Burke et al. (2016), showing that the use of an EHR did not improve the clinical quality of diabetic

care six months or five years after EHR adoption. In contrast, other studies of HIS on quality of care have displayed positive outcomes; for instance, EHR technology improves adherence to chronic disease medications and measured cardiovascular disease risk factors (Vollmer et al. 2014). For other aspects of preventive care, such as cost effectiveness, health promotion and administrative efficiency, previous studies also report various results. Some studies found a HIS influence on preventive care aspects, some studies produced a mixed result, and a few showed no difference on preventive care aspects (refer to Table 2.9).

One potential explanation for the ambiguous results of the studies outlined in Table 2.9 is that it is not clear whether other IT-related resources are accounted for in the studies evaluating the impact of HIS to performance. Thus, these studies do not reveal enough evidence supporting the ability of how HIS can improve preventive care outcomes to make a conclusive comment on this ambiguity. This is emphasised in a study by Yusof (2015), who states that most studies on HIS do not explain why it works well or poorly with specific users in specific settings, which suggests that more work is required related to human and organisational issues. Therefore, it was important for this research to study the integration of IS resources, especially with IT, such as HIS with other IT-related resources that may potentially create value and explain how it can improve preventive care performance. I expect that this research may contribute to a better understanding and make things less ambiguous in terms of how IS resources are integrated to develop IS competencies and IS capabilities to influence preventive care.

For HIS to gain widespread use, researchers suggest it needs to be integrated with other IT-related resources (Negash et al. 2018; Zakaria & Yusof 2016) to improve preventive care (Clauser et al. 2011). Some studies in other fields also suggest that technology resources when integrated with other IT-related resources can improve organisational performance (Bharadwaj 2000; Ravinchandran & Lertwongsatien 2005). In the preventive care area, several studies emphasise that healthcare organisations may need to go beyond technologies and instead must include both technology and human resources (Clauser et al. 2011; Sharma et al. 2016), particularly in optimising preventive care of chronic diseases (Clauser et al. 2011). For instance, Negash et al. (2018) emphasise that healthcare professional engagement

with HIS data and processes could result in sustained behaviour change motivation for chronic disease patients. Bates and Bitton (2010) discuss that today's EHRs perform most poorly in the domains of team care and care transitions, for which this type of functionality is largely absent from today's EHRs. Bates and Bitton (2010) suggest that major work is needed to improve clinical decision support to provide real-time communication and coordination among team members, especially for chronic diseases, registries and measurement. In addition, Shaw et al.'s (2011) study on electronic medical records (EMR) in primary care of chronic diseases suggest that the human resource is one of the important resources to improve the use of EMR or maintain it within a clinic. Similarly, Clauser et al. (2011) posit that an effective system for chronic conditions must include both humans and machines. Although Clauser and colleagues discuss the opportunities provided by IT for chronic care delivery, they found few efforts have been made to describe how to arrange IT to address and build an efficient system for a chronic condition and continually improve preventive care performance. The evidence of the link between IT and other IT-related resources towards performance is still ambiguous (Bharadwaj et al. 1999; Powell & Dent-Micallef 1997; Wade & Hulland 2004). The unavailability of publicly available data, the accelerated pace of IT innovation, the possible interactive effects between IT and human resources, and the intangible nature of IT capability are additional obstacles that hinder an understanding of whether, and how, IT can create value for an organisation (Lin 2007). Considering the meaningful role of IT when it is used with other relevant resources, this research needed to investigate how IT must be considerably integrated with other related resources, how it is managed and which of these resources are responsive to the prevention of chronic diseases in a complex healthcare environment, as well as contribute to research in the IS field. Therefore, there is a need to understand the interaction between IS resources.

Given the complex nature of healthcare, which is team-based, non-linear, event-driven, complex and full of deviations (Ozok et al. 2014), IT must be deployed in a way that the true value of the tool is realised (Prince & Herrin 2007). Prince and Herrin (2007) conclude that technologies are tools, but the value is not in the tool itself but rather in the way individuals and organisations use the tool. Bowman and Ambrosini (2000) state that organisations could produce value when resources are developed from the actions of people in the organisation and in association with other resources.

If these resources are not managed and integrated, the value will decrease (Bowman & Ambrosini 2000). Furthermore, the value of a resource is dependent upon the integration of resources (Black & Boal 1998), which will shape IS competencies and later develop IS capabilities (Peppard & Ward 2004). Therefore, the value is built upon the application of these IS competencies and IS capabilities, which are formed from an organisation's ability to manage and integrate these resources (Black & Boal 1998; Teoh 2010). Hence, in this research, I explored the IS competencies and IS capabilities that influence preventive care outcomes. Therefore, there is a need to explore how IS resources may provide value in preventive care.

In summary, HIS has great potential to improve preventive care. However, while the extant literature has focused on what the relationships are between HIS and preventive care, there remains a major gap in understanding of how HIS as a tangible-IT resource may potentially create value and influence performance. To achieve meaningful use of HIS in preventive care requires more than its applications; it must consider the complex nature of healthcare, the value inherent in how the tools are used, the inconclusive results from previous studies and a lack of integration with other IT-related resources. Because HIS holds great potential to facilitate preventive care in developing countries (Jabbour et al. 2003; Nohara et al. 2015), more work is needed to understand HIS and preventive care in developing countries to address local needs (Braa, Monteiro & Sahay 2004).

Therefore, this research encompassed IT and IT-related resources, such as tangible, human and intangible-IT resources to understand IS-resource integration and its influence on preventive care. This has the potential to allow me as the researcher to understand the development of IS resources, and HIS as a tool that can complement other IT resources, such as human-IT resources (Zakaria & Yusof 2016), as well as their impact on preventive care in developing countries (Jabbour et al. 2003). Thus, in this thesis, I argue that improvement in preventive care performance can be better understood through the integration of the IS resources, which includes HIS (a tangible-IT resource) as well as recognition of the critical importance of human and intangible-IT resources, which, through integration, will create IS competencies and IS capabilities. Specifically, the results of this research suggest that understanding the development of IS competencies and capabilities will help address concerns about the

integration of HIS as a tangible-IT resource with other IT-related resources such as human and intangible-IT resources towards achieving preventive care. This research reveals the complex interactions between IS resources, IS competencies and IS capabilities (Karimi Mazidi, Amini & Latifi 2014) or on 'resource → something happens→ performance' (Davis-Sramek, Germain & Krotov 2015, p. 247). Therefore, I needed to better understand the integration of IS resources and preventive care.

In order to address the above concerns, I adopted a case study methodology to explore the phenomenon and thus help to answer the research question:

How does a hospital integrate resources that lead to information system competencies and information system capabilities in preventive care performance?

2.5.5 *The hospital information system in Malaysia*

This section provides an overview of HIS in Malaysia as this will be where the case analysis will be based. Ismail, Abdullah, Shamsudin and Ariffin (2013) define HIS as a computer system designed to manage and process the hospital's medical and administrative information. HIS helps to prepare a positive environment for health professionals to perform their jobs efficiently, thus enabling them to achieve quality patient care services and medical research. HIS consists of many modules, with its function, department and users described in Table 2.10. Basically, HIS consists of at least two of the following IS components: clinical, financial, laboratory, nursing, pharmacy, picture archiving and communication, and radiology.

Table 2.10: Hospital information system components, functions and users – adapted from Ismail et al. (2013)

Components	Function	Department	User
Clinical information system	Computer-based system designed for collecting, storing, manipulating and making available clinical information important to the healthcare delivery process.	Clinical	Doctors, nurses
Financial information system	Computer system that manages the business aspects of a hospital; used by accountants in financial department.	Financial	Accountants
Laboratory information system	Computer information system that manages laboratory information for all the laboratory disciplines such as clinical chemistry, haematology and microbiology, that are used in the laboratory by laboratory officers.	Laboratory	Lab officers, doctors
Nursing information system	Computer system that manages clinical data from various healthcare environments; available in a timely and orderly fashion to aid doctors and especially nurses in improving patient care.	Ward	Nurses, doctors
Pharmacy information system	Complex computer system designed to meet the needs of pharmacy department.	Pharmacy	Pharmacists, doctors
Picture archiving and communication system	A loose term to describe a set of systems that facilitate the archiving, processing and viewing of digital and radiological images and their related information; this system is used in X-ray and imaging departments.	Imaging	Imaging officers, doctors
Radiology information system	Computer-based system that assists radiology services in the storing, manipulating and retrieving patient information.	Radiology	Radiologist, doctors

To date, a healthcare IS has existed in many healthcare institutions in Asia, including Malaysia (Amin, Isa & Hussein 2011; Huri et al. 2016; Ismail et al. 2013; Zakaria & Yusof 2016) aside from other countries like Singapore, Brunei and the Philippines. In Malaysia, the healthcare sector is divided into two healthcare providers – public and private (Tenth Malaysia Plan 2011–2015). Specifically, the public healthcare sector serves the largest number of people in Malaysia – 74% compared to 26% in the private sector (Jaafar et al. 2013). The large number of patients in public healthcare has led to complex workflows, which can be managed by adopting HIS (Ismail et al. 2013).

The Malaysian Government has recognised the importance of HIS adoption in the healthcare industry to society. In 1996, the Malaysian Government launched the Multimedia Super Corridor (MSC) to achieve Vision 2020 to becoming a developed country by 2020 (MOH Malaysia 1997). Under MSC, several significant projects were developed to ensure the growth of the country. These projects were known as flagship

projects (Salleh 2003). One of the significant flagship projects was MSC Telemedicine where HIS was to be introduced to activate the process of digitalisation of the healthcare sector (MOH Malaysia 1997). In line with the objective of improving quality and providing affordable health-service delivery, the process of digitalisation or the adoption of HIS in the public healthcare environment became vital (MOH Malaysia 1997).

Malaysia has extended basic healthcare services to its citizens, as can be seen from the achievements throughout the years. In 1999, Hospital Selayang was the first hospital in the country to adopt HIS, followed by Hospital Putrajaya as the second in 2000. The adoption of HIS is progressing, and in 2011, another two hospitals successfully adopted it – Hospital Bintulu, Sarawak and Hospital Sultanah Nur Zahirah, Terengganu (MOH Malaysia 2011).

Major efforts have been made to achieve the vision of MOH Malaysia, which is ‘A nation working together for better health’ (MOH Malaysia 2011, p. 6). The MOH vision is in line with the country’s Vision 2020, and can be achieved with the existence of thrust four in the Tenth Malaysia Plan – ‘to improve the standard and sustainability of quality of life’ (MOH Malaysia 2009, p.191). With the commencement of the Tenth Malaysia Plan in 2011, the Government of Malaysia planned to reform the healthcare delivery system with a focus on four key areas. First, transforming the delivery of the healthcare system; second, increasing quality, capacity and coverage of the healthcare infrastructure; third, shifting towards wellness and disease prevention, rather than treatment; and fourth, increasing the quality of human resources for health. Recently, in the 2017 Budget, the government allocated RM25 billion for health aspects including building and upgrading of new hospitals and clinics in Perlis, Kuching, Mukah, Jempol, Muar and Johor Bahru (Bernama 2016). Moreover, Malaysia’s total IS investment is expected to account for RM70.2 billion (US\$15.73 billion) in 2017, an increase of 7.3% over 2016 (Kumar 2017). This is due to an increase in demand for IS development plus the government’s desire to reach developed country status by 2020. Therefore, the government is making a push to expand the use of IT in medical care, health education, health-service management and telemedicine (MOH Malaysia 2011).

As of 2015, 21 out of 138, or 15.2%, of public hospitals have adopted HIS in Malaysia (Ismail, Abdullah & Shamsuddin 2015). The adoption of HIS in Malaysian public hospitals is divided into three categories – total hospital information system (THIS), intermediate hospital information system (IHIS) and BHIS – with 11 represented as THIS, two as IHIS and eight as BHIS (Ismail et al. 2010; Mohd & Syed Mohamad 2005; MOH Malaysia 2009, 2011).

In summary, the Malaysian Government has recognised the need to expand public healthcare, and hence the adoption of HIS in hospitals has been an important move towards that. Thus, it is interesting to explore how HIS is being used together with other resources to facilitate preventive care in the context of a Malaysian public hospital. The focus of this research was on how IS competencies and capabilities are developed from the integration of three IS resources; tangible, human and intangible-IT resources (Bharadwaj 2000) to facilitate preventive care performance.

2.6 The concept of information system competencies and capabilities

The concept of competencies and capabilities was founded in RBV theory and is known as the organisation's resources (Barney 1991, 2001). In an RBV, an organisation's objectives can be achieved through the coordination and exploitation of its resources, comprising assets, competencies and capabilities (Barney 1991, 2001; Kangas 1999; Wernerfelt 1984). Competencies refer to a 'firm's capacity to deploy resources, usually in combination, using organisational processes, to effect a desired end' (Amit & Schoemaker 1993, p. 35), whereas capabilities refer to 'the ability of an organisation to perform a coordinated set of tasks, utilising organisational resources, for the purpose of achieving a particular end result' (Helfat & Peteraf 2003, p. 999).

Some studies have used competency and capability concepts to refer to the same thing (Duhan, Levy & Powell 2001; Henderson & Cockburn 1994) while other researchers view them as two distinct concepts but relevant to each other (Ashurst, Doherty & Peppard 2008; Kangas 1999). However, previous studies do not often clarify the difference between these concepts clear (Ashurst, Doherty & Peppard 2008; Peppard & Ward 2004). For example, Henderson and Cockburn (1994) use the competency concept to show two different terms. 'Component competence' is used to describe resources while 'architectural competence' is referred to as capabilities (p.

65). The unclear usage of these two concepts makes it difficult to reach a standard definition.

In previous studies, researchers have introduced different types of competencies, such as distinctive competencies, routines, core competencies and business competencies. For instance, Snow and Hrebiniak (1980) use distinctive competence, which refers to 'an aggregate of numerous specific activities that the organisation tends to perform better than other organisations' (p. 317). Moreover, previous researchers consider competencies as related to routines. For example, Teece, Pisano and Shuen (1997) refer to competencies as organisational routines, that is 'when firm-specific assets are assembled in integrated clusters spanning individuals and groups so that they enable distinctive activities to be performed, these activities constitute organisational routines and processes' (p. 516). Similarly, Chen and Cheng (2008) identify competencies as 'socially complex routines that determine the efficiency with which organisations transform inputs into outputs' (p. 2).

Other researchers use core competencies and define them as 'the collective learning in the organisation ... how to coordinate diverse production skills & integrate multiple streams of technology' (Prahalad & Hamel 1990, p. 82), while Teece, Pisano and Shuen (1997) refer to core competencies as 'those competences that define a firm's fundamental business as core. Core competences must accordingly be derived by looking across the range of firm (and its competitors) products and services' (p. 516).

Bassellier and Benbasat (2004) use business competence, defining it as 'the set of business and interpersonal knowledge and skills possessed by IT professionals that enable them to understand the business domain, speak the language of business and interact with their business partners' (p. 676).

Rather than investigating all types of competencies, for this research I focused on IS competencies, which can be viewed as a pre-requisite for building IS capabilities. Throughout this research, the term *information technology* has been found to be largely used interchangeably with IS to refer to the same thing, depending on its context. IT refers to technological based knowledge, while IS refers to a combination of technology and human-based knowledge (Wade & Hulland 2004). Sometimes, the

term IT is used jointly as IS/IT, which shows IT as part of IS. Table 2.11 presents the definition of IS competencies.

Table 2.11: Definition of information system competencies

Author	IS/IT Competency
Dehning and Stratopoulos (2003)	IT competencies focus on information technologies that can allow organisations to achieve a competitive advantage.
Tippins and Sohi (2003)	IT competencies refer to the extent to which an organisation is equipped with IT infrastructure, IT skills knowledge and experience as well as effective IT operations utilisation.
Peppard and Ward (2004)	IS competencies refer to 'people applying their knowledge, integrating their knowledge, interacting with others and coordinating their actions by performing roles in organisational structures and processes' (p. 180).
Croteau and Raymond (2004)	IT competencies refer to information technologies comprised of connectivity, flexibility and technological scanning meant to support the organisation's strategic competencies through the effective use and management of IT.
Tarafdar and Gordon (2007)	IS competencies consist of seven dimensions, which are knowledge management, collaboration, project management, ambidexterity, IT/innovation governance, business-IS linkage and process modelling.

Note: IT = information technology; IS = information system

As seen in Table 2.11, some researchers use the term IS, and some use IT competencies. In summary, IS competencies comprise IT (Dehning & Stratopolous 2003) or are both technology and human-knowledge based (Croteau & Raymond 2004; Peppard & Ward 2004; Tarafdar & Gordon 2007; Tippins & Sohi 2003). Thus, in this thesis, I use the term IS instead of IT, following Peppard and Ward's (2004) definition of IS competencies, which is explained further below.

Table 2.12 shows the definitions of IS capabilities listed in previous studies, showing that researchers have their own understanding of IS capability based on different perspectives. Thus, it is difficult to form a unified definition and attain an understanding of the concepts. A review of the literature suggests that, previously, IS capability was known mainly to concern technological capabilities (Sabherwal & Kirs 1994), but later, researchers included managerial capabilities into the concepts (Bharadwaj, Sambamurthy & Zmud 1999). Recently, many researchers have extended and introduced a more comprehensive view of IS capability that includes not only technological aspects but also a managerial element. Specifically, studies by Bharadwaj (2000), King (2002), Peppard and Ward (2004), Bhatt and Grover (2005),

Wang and Alam (2007), Cheng, Zang and Tian (2008), Jiao, Chang & Lu (2008), Qingfeng and Daqing (2008), Ringim, Razalli and Hasnan (2012), Chen et al. (2014), Choorng-Shyong and Po-Yen (2016) primarily add to the meaning of IS capability to comprise both technological and managerial elements within the IS field.

Therefore, the position I take in this thesis is that the RBV hierarchy starts with resources at the bottom, continues with competencies, and ends with capabilities as a higher-level element (Ashurst, Doherty & Peppard 2008; Hatten & Rosenthal 1999; Kangas 1999; Stalk, Evans & Shulman 1992).

Table 2.12: Definition of information system capabilities

Author	IS/IT capability
Sabherwal and Kirs (1994)	IT capability focuses on information technologies, that is, computer and communication hardware and software and information processing capacity.
Bhatt and Grover (2005)	IT capability refers to IT infrastructure, IT-business experience and relationship infrastructure.
Bharadwaj, Sambamurthy and Zmud (1999)	IT capabilities comprise of six categories: IT-business partnerships, external IT linkages, business IT strategic thinking, IT-business process integration, IT management, and IT infrastructure.
Bharadwaj (2000)	IT capability refers to the ability to mobilise and deploy IT-based resources in combination or co-present with other resources and capabilities.
King (2002)	IT capabilities are the aggregation of hardware, software, shared services, management practices, and technical and management skills.
Peppard and Ward (2004)	IS capability consists of three interrelated attributes: a fusion of business knowledge with IT knowledge, a flexible and reusable IT infrastructure, and an effective use process.
Fang, Wu and Wu (2006)	IT capability is divided into three capabilities: the capability of internal integration, the capability of business process redesign, and the capability of strategic revolution.
Wang and Alam (2007)	IT capability is a set of hardware, software, shared service, management practice, technology and management skill.
Lai, Wang and Zhao (2008)	IT capability is based on IT resource commitment and managerial involvement.
Cheng, Zhang and Tian (2008)	IT capability includes IT infrastructure capacities with sharing network, wide range of services and a high degree of flexibility; IT human resource skills with professional agility, customer satisfaction and good communication; and comprehensive management abilities using IT resources and other complete business models and technology deployment plans.
Jiao, Chang and Lu (2008)	IT capability means enterprise formation, transfer and deployment of enterprise information technology resources, support and improvement of other unique functions that are competent at strength and skill, creating latent potential for maintaining continuous competitive advantage, including IT architecture and routine, IT infrastructure, IT human resources and IT relationship assets.
Qingfeng and Daqing (2008)	IT capability is a kind of organisational ability of mobilising, deploying, integrating information resources combined with other enterprise resources and abilities to reach some certain goal, including IT infrastructure, IT management capability, and IT-business alignment capability.

Author	IS/IT capability
Khani et al. (2011)	IS capability is the ability to deliver system, control IT costs, and affect objectives of the business with IT implementation.
Lu and Ramamurthy (2011)	IT capability is conceptualised as a latent construct reflected in three dimensions: IT infrastructure capability (the technological foundation), IT business spanning capability (business–IT strategic thinking and partnership), and IT proactive stance (opportunity orientation).
Yeh Lee and Pai (2012)	IS capability is divided into individual capability, group capability and organisation capability.
Ringim, Razalli and Hasnan (2012)	IT capability includes both the technical and managerial expertise (IT skill knowledge, IT operations and IT object) required to provide reliable physical services and extensive electronic connectivity within and outside the firm.
Chen et al. (2014)	Refers to six dimensions: IT infrastructure, IT-business partnerships, business IT strategic thinking, IT-business process integration, IT management, and external IT linkage.
Choorng-Shyong and Po-Yen (2016)	IT capability refers to the combination of various IT resources, for example, IT infrastructure, human-IT skills and IT-enabled intangibles are firm-specific capabilities and can help a firm to create some superior application.

Note: IT = information technology; IS = information system

In summary, after synthesising previous researchers' definitions of IS competencies and IS capabilities, for this research I adopted Peppard and Ward's (2004) ideas about IS competencies and IS capabilities but modified it to suit the healthcare context (refer to Figure 2.3). I adopted Peppard and Ward because first, the definitions suggested are specific to the IS area, which suits this research, and second, the definitions specifically address distinct concepts that are in line with the process that starts from resources to competencies and ends with capabilities.

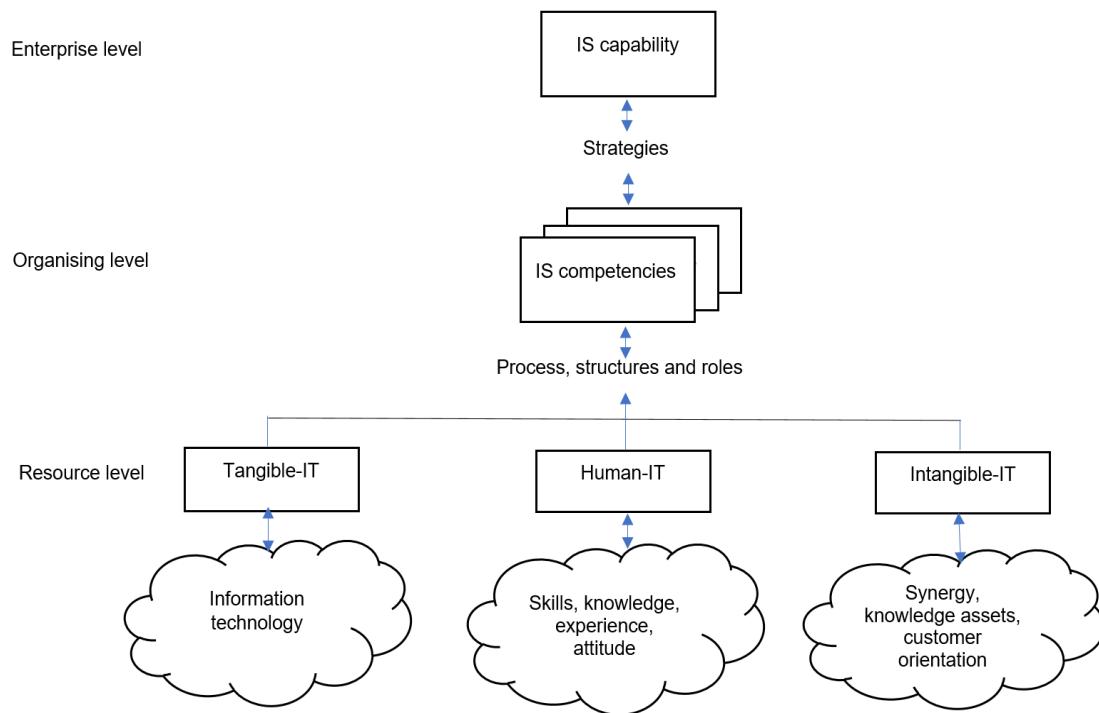


Figure 2.3: Information system competencies and capabilities concepts (Adapted from Peppard and Ward 2004)

Referring to Figure 2.3, Peppard and Ward (2004) suggest that through resource-level bundling, IS competencies are developed at the organising level, and through organising-level bundling result in IS capability development at the enterprise level.

In this research, IS competencies refer to the strength of individual healthcare practitioners developed from the application and interaction of tangible, human and intangible-IT resources when performing roles in organisational structures and processes.

IS capabilities refer to the hospital's potential to organise and utilise a collective of IS competencies to enable the implementation of the hospital's strategy in supporting organisational processes, activities and workflow, thus affecting preventive care performance.

2.6.1 Information system competencies, information system capabilities and organisational performance

IS competencies and capabilities are important elements to achieve productivity and performance of an organisation as presented in Table 2.13. Previous studies have

clearly examined the effect of IS-related resources and competencies (Byrd 2001; Huang 2011; Martín-Rojas, García-Morales & Bolívar-Ramos 2013) and IS capabilities on organisational performance (Aral & Weill 2007; Fang et al. 2006; Lai et al. 2008; Lin 2007; Ringim, Razalli & Hasnan 2012; Wu et al. 2006). For example, Pan, Pan and Lim's (2015) study focused on IS and non-IS resources and capabilities on firm productivity. Another study was carried out by Tarafdar and Gordon (2007) to understand the role of IS competencies on process innovation in health organisations. Huang (2011) developed a comprehensive framework of IS competencies that affect innovation performance. In addition, IS competencies have also been studied in relation to research and development (Li & Xie 2011), in sustaining competitive advantage (Cragg 2008; Wade & Hulland 2004), at the health-system level (Whittaker et al. 2015) and in supply-chain management (Ngai, Chau & Chan 2011). IS capabilities have been studied generally in relation to organisational performance (Aral & Weill 2007; Chen et al. 2014; Fang et al. 2006; Ilmudeen & Bao 2018) or specifically on e-government performance (Dahiya & Mathew 2016), innovation performance (Qammach 2016), the supply chain (Wu, Wang & Wang 2006; Yu et al. 2017), financial performance (Wu et al. 2017), future earnings (Wang & Alam 2007), market value (Muhanna & Stoel 2010), audit processes (Chen et al. 2014), bank performance (Ringim, Razalli & Hasnan 2012) and firm ownership structure or capital markets (Schafferling & Wagner 2015).

Furthermore, IS competencies and IS capabilities play an important role in many industries as a means of achieving organisational performance. For example, IS competencies are applied for performance outcomes in the business industry (Croteau & Raymond 2004), IT industry (Huang 2011; Martín-Rojas, García-Morales & Bolívar-Ramos 2013) and the pharmaceutical industry (De Carolis 2003), while IS capabilities are important for organisational performance in the banking industry (Lin 2007; Ringim, Razalli & Hasnan 2012), the audit environment (Chen et al. 2014) and supply-chain management (Lai et al. 2008; Wu et al. 2006). Table 2.13 summarises the research about IS competencies and/or IS capabilities from 2004 to 2018.

Table 2.13: Studies of information system competencies/capabilities and their relationship to different types of performance

Study of information system competencies or/and capabilities	Performance
Croteau and Raymond (2004)	Business performance
Ravinchandran and Lertwongsatien (2005)	Firm performance
Wu et al. (2006)	Firm performance
Tarafdar and Gordon (2007)	Process innovation
Chen and Cheng (2008)	Organisational performance
Cragg (2008)	Small-firm performance
Bi, Smyrnios and Kam (2010)	Organisational performance
Yu and Xin-quan (2011)	Innovation performance
Ngai, Chau and Chan (2011)	Firm performance
Lu and Ramamurthy (2011)	Organisational agility
Yeh, Lee and Pai (2012)	E-business performance
Martín-Rojas, García-Morales and Bolívar-Ramos (2013)	Organisational performance
Chen et al. (2014)	Audit process
Pan, Pan and Lim (2015)	Firm productivity
Ong and Chen (2016)	Firm performance and growth opportunities
Ilmudeen and Bao (2018)	Firm performance

Hence, this research aimed to investigate how IS competencies and IS capabilities are being used to facilitate preventive care performance. Drawing upon the IS research, most research has concluded that IS competencies and capabilities positively influence the performance of the organisation (Bharadwaj 2000; Huang 2011; Lu & Ramamurthy 2011; Ravichandran & Lertwongsatien 2005; Tarafdar & Gordon 2007). Essentially, it is important for organisations to understand the relationship of IS competencies (Huang 2011) and IS capabilities on their performance (Ravichandran & Lertwongsatien 2005). Despite a considerable amount of research showing a positive relationship between these resources and organisational performance, examining simple relationships between these two elements is insufficient to understand how the resources are used for achieving better performance (Luo, Fan & Zhang 2012).

Molloy et al. (2011) found that studies often overlooked the consideration related to resource use (how firms deploy resources in combination with other resources). Liang, You and Liu (2010) suggest that organisational performance can be enhanced by the integration of IS resources and IS capabilities. IS capabilities are built on practices and IS competencies (Aral & Weill 2007), thus enabling IS competencies and capabilities

to serve as a means of transforming IS resources into higher value for an organisation (Byrd 2001; Wu et al. 2006). This is true when the evidence suggests that the use of IT per se does not guarantee enhanced organisational performance (Angst et al. 2011). Hence, IT generates value when it is integrated with other IS resources to achieve performance (Angst et al. 2011).

Previous studies emphasise the need to investigate and explain the possible interactive effects between IS resources and IS capability and how these resources can create value for an organisation (Huang 2011; Lin 2007). The research about the effect of these resources on organisational performance is crucial because the underlying mechanism by which organisational performance is achieved (Liang, You & Liu 2010) has not been fully understood (Huang 2011; Luo, Fan & Zhang et al. 2012). Furthermore, Liang, You and Liu (2010) found that understanding the indirect relationship between IS resources and performance provides a channelling view that can better explain the value of IS and its effect on performance. Therefore, this research investigated the 'black box' (Yin 2014, p. 156) of how IS competencies and IS capabilities are developed to achieve preventive care performance.

2.6.2 Information system competencies and capabilities in healthcare

A competency framework is used in many healthcare settings and is frequently applied in certain health areas, such as in developing health-education modules, healthcare training, career promotion, employment, preventive care of chronic diseases, personalised medicine, collaborative practice and infectious diseases, as presented in Table 2.14.

Table 2.14: Competency framework used in different healthcare settings

Health areas	Authors
Education	Androwich, Kraft and Haas (2008); Campbell et al. (2015); Fetter (2009); Hsu et al. (2012); Gray and Sim (2007); McIntyre-Hite, Kadrie and Hudgins (2015); Morris, Ono and Golemboski (2013); Oeseburg, Hilberts and Roodbol (2015); Ornes and Gassert (2014)
Training	Comber, Crawford and Wilson (2018); Cunningham et al. (2015); Cowling, Newman and Leigh (1999); Deyo, Swartwout and Drenkard (2016)
Career promotion	Barry, Battel-Kirk and Dempsey (2012); Comber, Crawford and Wilson (2018); Meadows (2016)
Employment	Barakat et al. (2013); Tzeng and Ketefian (2003)
Preventive care of chronic diseases	Halcomb et al. (2016)
Personalised medicine, health coproduction and smart health	Kokol et al. (2018)
Collaborative practice	Hepp et al. (2015)
Infectious diseases	Kaye et al. (2015)

Table 2.14 shows there have been a number of studies on competencies that relate to different health areas based on specific healthcare provider professions, such as for doctors (Comber, Crawford & Wilson, 2018) and nurses (Androwich, Kraft & Haas 2008; Fetter 2009; Meadows 2016). However, most of these studies do not provide enough information about the hospital IS competencies and capabilities framework of their healthcare practitioners to support healthcare performance, which is about preventive care for chronic diseases (Halcomb et al. 2016). By investigating IS competency and capability development, there may be select IS competencies from each healthcare practitioner that can be developed into IS capabilities to provide benefits for preventive care. Furthermore, none of the studies have observed the evolution from IS competencies of different healthcare practitioners into IS capabilities for preventive care performance. The purpose of this research was to, therefore, develop the theoretical link between IS competencies and IS capabilities from key IS resources using the resource orchestration perspective and the CEM as the theoretical lens to produce a model to illustrate the transformation process of IS resources, IS competencies and IS capabilities in achieving preventive care performance.

Therefore, this research explored IS competency and capability development in a healthcare setting on the antecedents of the organisation's performance that refer to preventive care. Understanding IS competencies and IS capabilities in relation to preventive care performance is important because, as healthcare organisations evolve with the use of advanced health technology (Rasmi et al. 2018), the diverse skills and IS competencies of healthcare practitioners are crucial for improvement of the healthcare organisation's performance (Comber, Crawford & Wilson 2018; Gaspard & Yang 2016) specifically on preventive care of chronic diseases (Halcomb et al. 2016). Previous studies found healthcare practitioners' skills in utilising technologies such as HIS could help to reduce repeated medical errors that cause complications for the patient and may lead to death (Rasmi et al. 2018). Moreover, appropriate healthcare practitioners' skills and experience are important to improve the quality and safety of healthcare, and lower the costs (Hersh et al. 2010). However, previous studies report that both developed and developing countries have an inadequate number of individuals with IT skills and competencies to improve healthcare outcomes (Adekele et al. 2015; Comber, Crawford & Wilson 2018; Fetter 2009; Ishijima et al. 2015). Therefore, it is important to identify the healthcare practitioners' role, and develop their skills and competencies concerning technologies consistent with local cultures, language and health systems that will be needed to realise the full benefit of these technologies, thus providing better services to cope with chronic diseases in developing countries (Hersh et al. 2010; Kokol et al. 2018).

Furthermore, much of the preventive care delivered in the healthcare sector relies on IS and IT (Clauser et al. 2011; Milani, Bober & Lavie 2016; Wei et al. 2017). Healthcare operations (Adler-Milstein & Bates 2010) and service delivery (Haque et al. 2013) nowadays are IT-based (Lahiri 2013), thus it is important to understand how IT can best be used in chronic disease prevention (Ahmad & Tsang 2013; Moerenhout, Devisch & Cornelis 2018; Smith et al. 2016). For example, healthcare organisations have adopted sophisticated technology such as HIS as a tool to improve healthcare services (Deimazar et al. 2018; Wheatley 2013) especially for chronic disease prevention (Himes & Weitzman 2016). Similarly, health organisations have used HIS to facilitate preventive care specifically in controlling, managing and treating the occurrence of chronic diseases (Ahmad & Tsang 2013; Bauer et al. 2014b; Kozak et al. 2017). Thus, realising that HIS is a viable component for effective healthcare

(Bernardi 2017; Frimpong et al. 2013; Hameed et al. 2016), there is a growing need to ensure that the advanced use of technology is integrated with other IT resources – the abilities and skills of healthcare practitioners towards achieving healthcare performance (Bembridge, Levett-Jones & Jeong 2011; Whittaker, Mares & Rodney 2013). This is because the contribution of IT towards building a more sustainable healthcare system cannot be achieved by an individual person, but relies upon active use of IT from all clinicians in the healthcare practice (Gray & Sim 2007). Therefore, previous studies suggest that healthcare practitioners must learn, acquire and develop competencies and capabilities (Ganasegeran et al. 2015; Gray & Sim 2007; Tzeng & Ketefian 2003) to make full use of the technology and respond to changing health environments, such as preventive care (Bauer et al. 2014a; Halcomb et al. 2016). Based on the literature, this research investigated how IS resources are integrated to form IS competencies and IS capabilities and are linked with preventive care performance. In order to explore this phenomenon, the next section develops a theoretical link between IS competencies and IS capabilities from IS resources.

2.7 Theory selection

Influential theoretical models in IS fields include the theory of reasoned action (TRA) (Fishbein & Ajzen 1975), the theory of planned behaviour (TPB) (Ajzen 1991), the technology acceptance model (TAM) (Davis 1989), the theory of innovation diffusion (TID) (Moore & Benbasat 1991; Rogers 1995), the task-technology fit (TTF) model (Goodhue & Thompson 1995), the unified theory of acceptance and use of technology (UTAUT) model (Venkatesh et al. 2003) and the technology organisation and environment (TOE) model (Tornatzky, Fleischer & Chakrabarti 1990). Despite these theories being employed widely in the IS literature, the TRA, TPB, TAM, TID and UTAUT, TOE and TTF were found not suitable for this research for several reasons.

First, these theories are intended to only explain and predict outcomes from a set of factors, whereas the theory required for this research needed to explain how things happen for a particular situation that is real or known as ‘theory for understanding’ (Gregor 2006, p. 624).

Second, the TRA, TPB, TAM, TID and UTAUT were found not suitable for this research because they are utilised mainly for individual level analysis (Coeurderoy, Guilmot &

Vas 2014; Escobar-Rodríguez & Romero-Alonso 2013; Kijsanayotin, Pannarunothai & Speedie 2009; Ngadiman et al. 2014; Tung, Chang & Chou 2008), the TOE is more extensively used for organisational level analysis (Ahmadi, Nilashi & Ibrahim 2015) and the TTF emphasises fit between individual abilities, technology characteristics and task requirements (Laugesen & Hassanein 2017). Most of the models presented seem to concentrate strongly on analysing factors, such as attributes/factors of individual users, attributes of technology, and/or attributes of organisations, rather than analysing process factors that involve collaborative attributes of users, technologies and working processes as a whole. Therefore, these theories cannot be used as they do not support the aim of this research.

In this research, my main focus was on understanding the development of IS competencies and IS capabilities towards achieving preventive care performance. Therefore, theories related to resources and performances, such as Porter's five forces, RBV (Barney 1991, 2001) and the dynamic capabilities perspective (Teece, Pisano & Shuen 1997) were considered.

Porter's five forces model was developed to analyse the competition within an industry through five competitive forces to determine profitability (Lee, Kim & Park 2012). There are five causal variables highlighted in the model to explain superior performance: first, the bargaining power of the buyers; second, entry barriers; third, rivalry; fourth, substitutes; and fifth, bargaining power of the suppliers (Lee, Kim & Park 2012). Nevertheless, there are certain limitations associated with Porter's model that do not match this current research. First, Porter's model considers the industry as the unit of analysis (Bridoux 2004), whereas this research focused on a firm/organisation or individual resources as the unit of analysis. Second, Porter's model concerns external impact, in showing that the level of threat and opportunity in an industry influences the firm's strategy of positioning its products produced from resources and capabilities, and the market it serves (Bridoux 2004). However, this research was concerned with an internal perspective that is at the firm's level of resources and capabilities. Third, Porter's model is relatively abstract and highly analytical (Grundy 2006), and thus fails to present its analytical concepts in simple terms for managers to adapt (Grundy 2006), thereby reducing its ability to explain the phenomenon being studied.

The RBV theory emphasises analysing the internal characteristics of a firm, which focuses on the resources possessed within an organisation (Barney 2001). The theory provides a framework as an approach to analyse organisational success; particularly the bundling of resources is the determining factor of performance. However, RBV has a number of limitations. First, RBV emphasises the value of an individual resource as the crucial factor to achieving firm performance. Nevertheless, firm success does not only depend on the individual resources a firm possesses, but rather is achieved through the firm's combination or bundle of resources (Kraaijenbrink, Spender & Groen 2010). Second, RBV has been criticised for ignoring some considerations, such as how resources are developed, how they are integrated and how they are released (Wade & Hulland 2004). This shows that RBV insufficiently recognises the role of managers in achieving firm performance (Kraaijenbrink, Spender & Groen 2010). Taken together, the criticisms of RBV suggest that a firm needs both a bundle of resources and the role of managers in organising the resources for the firm's success. However, with its focus on resources and performance, the RBV theory still usefully provided a foundation for this research so long as the impact of managers on firm performance could also be incorporated within its explanatory power.

The dynamic capability (DC) perspective is defined as 'the ability to integrate, build, and reconfigure internal and external competencies to address rapidly-changing environments' (Teece, Pisano & Shuen 1997, p. 516). The concept of DC attempts to understand the mechanisms underlying how exactly key resources benefit the firm in a changing business environment (Wade & Hulland, 2004). DC focuses on two key aspects to support competitive advantage. First, DC uses the term *dynamic*, which refers to 'the capacity to renew competences so as to achieve congruence with the changing business environment' (Teece, Pisano & Shuen 1997, p. 515). The second aspect refers to capabilities which 'emphasises the key role of strategic management in appropriately adapting, integrating, and reconfiguring internal and external organisational skills, resources, and functional competences to match the requirements of a changing environment' (Teece, Pisano & Shuen 1997, p. 515). However, DC tends to be adopted in a rapidly-changing environment, and is relevant for multinational enterprises (Teece, Pisano & Shuen 1997). Instead, this research was conducted in a stable environment, which has a public hospital as the type of organisation.

2.8 The selection of the resource-based view theory

In consideration of its limitations, for the reasons outlined in the preceding section, this research used the RBV theory as a foundation for investigation of the IS resources, IS competencies and IS capabilities that enhance organisational performance (Chae, Koh & Prybutok 2014; Liang, You & Liu 2010; Luo, Fan & Zhang 2012; Mishra et al. 2018; Shan et al. 2014; Yeh, Lee & Pai 2012).

RBV was developed within the context of a firm and its competitive positioning where performance is usually measured in terms of firm's financial performance, or market share, relative to its competitors (Burton & Rycroft-Malone 2014). In this research, I applied RBV in a context which is a not-for-profit public sector (Arya & Lin 2007), where public health systems operate in a tightly managed market (Burton & Rycroft-Malone 2014). Not-for-profit organisations are also distinct from for-profit and competitive organisations, for example, public healthcare organisations reinvest revenues back into their organisations to meet their organisations' purposes (Arik et al. 2016). However, competition can exist in other aspects of organisational performance in non-profit organisations (Burton & Rycroft-Malone 2014; Arya & Lin 2007), including quality improvement (Ferlie 2014); effectiveness and value for money (Pee and Kankanhalli 2016); and operational efficiency through value driven strategy (Arik et al. 2016). Thus, this research used RBV in a not-for-profit public hospital.

RBV theory was adopted because it focuses on resources-related study such as resource integration and has been proven useful in IS research (Cragg 2008; Wade & Hulland 2004) specifically in non for profit organisation (Arya & Lin 2007). For instance, based on the latest RBV developments, IS shows an indirect effect on organisational performance (Wade & Hulland 2004). This is particularly true when IS resources interact and integrate with other IS and IT-related resources to provide better organisational performance (Luo, Fan & Zhang 2012; Ravinchandran & Lertwongsatien 2005). In view of the literature, I believe that the integration of IS resources could lead to the development of IS competencies and capabilities that provide value for healthcare organisations to improve their performance. Therefore, the research question for this PhD is:

How does a hospital integrate resources that lead to information system competencies and information system capabilities in preventive care performance?

2.8.1 Resource categorisation

Resources can be categorised into three classifications – physical capital resources, human capital resources and organisational capital resources (Barney 1991). Physical capital resources consist of technology, plant and equipment, geographic location and access to raw materials. Human capital resources include training, experience, judgement, intelligence and relationships, while organisational capital resources comprise formal reporting structure, formal and informal planning, controlling and coordinating systems, and informal relationships among groups internally and externally. As Barney (1991) points out, resources are bundles of tangible and intangible assets and come in different forms that encompass capabilities, organisational processes, firm attributes, and information and knowledge that are controlled by a firm and are used in implementing strategies.

2.8.2 Theoretical limitations

RBV is criticised for placing too much focus on choice of resources or the resources an organisation possesses, rather than emphasising what an organisation does with its resources (Kraaijenbrink, Spender & Groen 2010); or what Priem and Butler (2001) state as having a lack of managerial implications. In other words, resources can only be the source of achieving better organisational performance if they are exploited through organisational processes. Sirmon et al. (2011) found that past research suggests possessing resources alone is insufficient to achieve better organisational performance. Instead resources should be managed to attain their full value. Therefore, the resource orchestration perspective was used in this research to address the limitations of RBV in understanding the managerial and organisational processes through which the resources become valuable.

The literature explains that resources alone cannot create value (Ashurst, Doherty & Peppard 2008); they need to be transformed in order to generate value (Bowman & Ambrosini 2000). Value can be created from an organisation's ability to manage and

integrate these resources through the application of capabilities and competencies (Black & Boal 1998; Teoh 2010). According to RBV theory, competencies and capabilities are valuable resources that can contribute to better organisational performance (Coates & McDermott 2002; Teece, Pisano & Shuen 1997). Competencies enable unique activities to be performed (Teece, Pisano & Shuen 1997), solve problems (Henderson & Cockburn 1994), enable business understanding (Bassellier & Benbasat 2004), and transform organisational resources to improve performance (Chen & Cheng 2008). Capabilities, on the other hand, have the potential to enable organisations to differentiate their products or services and create economic value through the creation and implementation of strategies (Barney 2002), which can lead to higher performance (Karimi Mazidi, Amini & Latifi 2014; Liang, You & Liu 2010).

Previous studies have found that IS resources and capabilities can influence and consequently improve organisational performance (Ilmudeen & Bao 2018; Kawakami, Barczak & Durmuşoğlu 2014; Luo, Fan & Zhang 2012; Zhang, Zhao & Kumar 2017). However, RBV fails to adequately explain how IS resources interact with one another and influence organisational performance (Wade & Hulland 2004). In addition, the process that explains how IS/IT resources interact, are created and contribute to organisational performance is still unclear (Cragg 2008; Liang, You & Liu 2010). Previous research suggests that examining relationships between resources helps to provide a better understanding of the IS role and its interactions with other IS/IT-related resources that affect organisational performance (Wade & Hulland 2004). This is because IS/IT resources operate effectively when integrated with other resources, thus leading to better organisational performance (Wade & Hulland 2004).

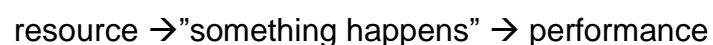
Overall, there are some issues identified in previous studies using RBV. First, there is little understanding of how resources are organised and create value. Second, the IS resources to organisational performance relationship research is still insufficient (Liang, You & Liu 2010). Third, little is known about how resources are used to influence organisational performance and the need to expand RBV using the resource orchestration perspective (Davis-Sramek, Germain & Krotov 2015; Sirmon et al. 2011). Fourth, there is lack of application of RBV in the field of IS (Wade & Hulland 2004) in healthcare organisations (Ferlie 2014).

Therefore, the next two sections address these issues, reinforcing RBV with the resource orchestration perspective and CEM.

2.8.3 Resource orchestration perspective and chain of effect model

Barney, Ketchen and Wright (2011) suggest that resource orchestration offers a foundation for extending RBV in meaningful new directions. Resource orchestration draws upon both resource management (Sirmon, Hitt & Ireland 2007) and the asset orchestration framework (Helfat et al. 2007). Resource management has been explicitly linked with RBV theory, while asset orchestration draws from the DC concept, which is indirectly linked to RBV theory. This recent development is an extension of RBV theory (Chadwick, Super & Kwon et al. 2015) emphasising the role of managerial action to influence organisational outcomes, such as value creation within capabilities and resource-based logics (Sirmon et al. 2011). The resource orchestration perspective may facilitate the role of managerial action through the resource orchestration actions of structuring, bundling and leveraging (Sirmon et al. 2011). Structuring refers to the structuring of a resource portfolio, including acquiring, accumulating and divesting; bundling is the process of using resources to build capabilities, including stabilising, enriching and pioneering; and leveraging emphasises leveraging capabilities to create value, including mobilising, coordinating and deploying (Sirmon et al. 2011). Appendix 5 presents a variety of ways to practically and theoretically apply the resource orchestration perspective to link resources to performance (Lanza, Simone & Bruno 2016; Wales et al. 2013).

Sirmon and colleagues provide an explanation of the resource orchestration perspective that acknowledges the importance of managerial actions related to organisational resources (Sirmon et al. 2011). However, Davis and colleagues present a simplified model – CEM – to clearly demonstrate how the resource orchestration perspective could fit between resource and performance (Davis-Sramek, Germain & Krotov 2015) in Figure 2.4.



```
graph LR; A[resource] --> B["something happens"]; B --> C[performance];
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resource → "something happens" → performance

Figure 2.4: Chain of effect model (Davis-Sramek, Germain and Krotov 2015, p. 247)

Thus, considering the limitations of the both the RBV and resource orchestration perspective, this research investigates the influence of IS competencies and capabilities towards preventive care performance using a combination of the resource orchestration perspective (Sirmon et al. 2011) and the CEM (Davis-Sramek, Germain & Krotov 2015). Both are used to mitigate the aforementioned limitations by examining 'how resources are managed or orchestrated' (Sirmon et al. 2011, p. 1407) to influence performance or specifically to examine the event between resource and performance (Davis-Sramek, Germain & Krotov 2015).

The resource orchestration perspective and CEM provide a bridge between resources and performance. Thus, the combination of both refines the resource orchestration perspective by first, having an explanation of the resource orchestration perspective (Sirmon et al. 2011) and second, having the model to clearly illustrate Sirmon's explanation on the resource orchestration perspective (Davis-Sramek, Germain & Krotov 2015), which strengthened the research. Additionally, this perspective and model strengthen the research because they are appropriate to the case, and the concepts and propositions from both represent a close fit with the empirical reality (Eisenhardt 1989).

2.8.4 *Modified resource orchestration model*

I propose a conceptual model to address the issues mentioned and extend the explanatory power of the RBV. Thus, the theory and perspective used to examine the case study hospital is shown in Figure 2.5.

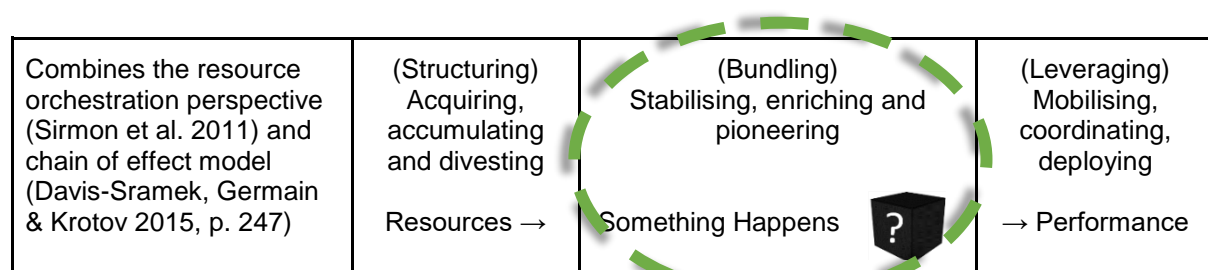


Figure 2.5: Modified resource orchestration model as the theoretical lens of resources to performance

The main aim of proposing this modified resource orchestration model is to apply the model as a theoretical lens to explore how IS resources enable the case study hospital to develop IS competencies and IS capabilities and thus improve preventive care.

Although previous research has investigated the contributions of IS resources, IS competencies and IS capabilities (Ghobakhloo & Azar 2018; Tarafdar & Gordon 2007; Teoh 2010) to organisational performance (Ravinchandran & Lertwongsatien 2005), the relationship between these resources (IS competencies and IS capabilities) have not been systematically examined (Karmini Mazidi, Amini & Latifi 2014).

Based on the literature, this research developed the modified resource orchestration model (refer to Figure 2.5) by adopting RBV theory, the resource orchestration perspective and the CEM. Through structuring, bundling and leveraging processes (Sirmon et al. 2011) this model became a theoretical lens for this research to examine the effect of resources directly on performance. To achieve performance in this case refers to preventive care performance; first, a hospital needs to identify its resources to develop a resource portfolio; second, the hospital needs to bundle its resources in such a way that the hospital could transform the resources into valuable ones that refer to the development of IS competencies and IS capabilities. The oval with green dashes with a black box inside it in Figure 2.5, shows that this part is crucial and needed to be researched to understand how IS competencies and IS capabilities are developed to create values for hospital preventive care performance. Finally, the hospital may leverage its IS capabilities to achieve preventive care performance.

Figure 2.6 is a conceptual model that illustrates the constructs from the modified resource orchestration model. *Resources* refer to IS resources, which consist of tangible, human and intangible-IT resources (Bharadwaj 2000), while *performance* refers to preventive care performance – administrative efficiency, health promotion, quality of care and cost effectiveness. The oval with purple dashes represents the area that needed to be explored in this research. The resource orchestration process – structuring, bundling and leveraging – helps to explain how the three categories of IS resources (tangible, human, and intangible-IT resources), are structured and bundled to create IS competencies and IS capabilities, and then leveraged to achieve hospital preventive care performance.

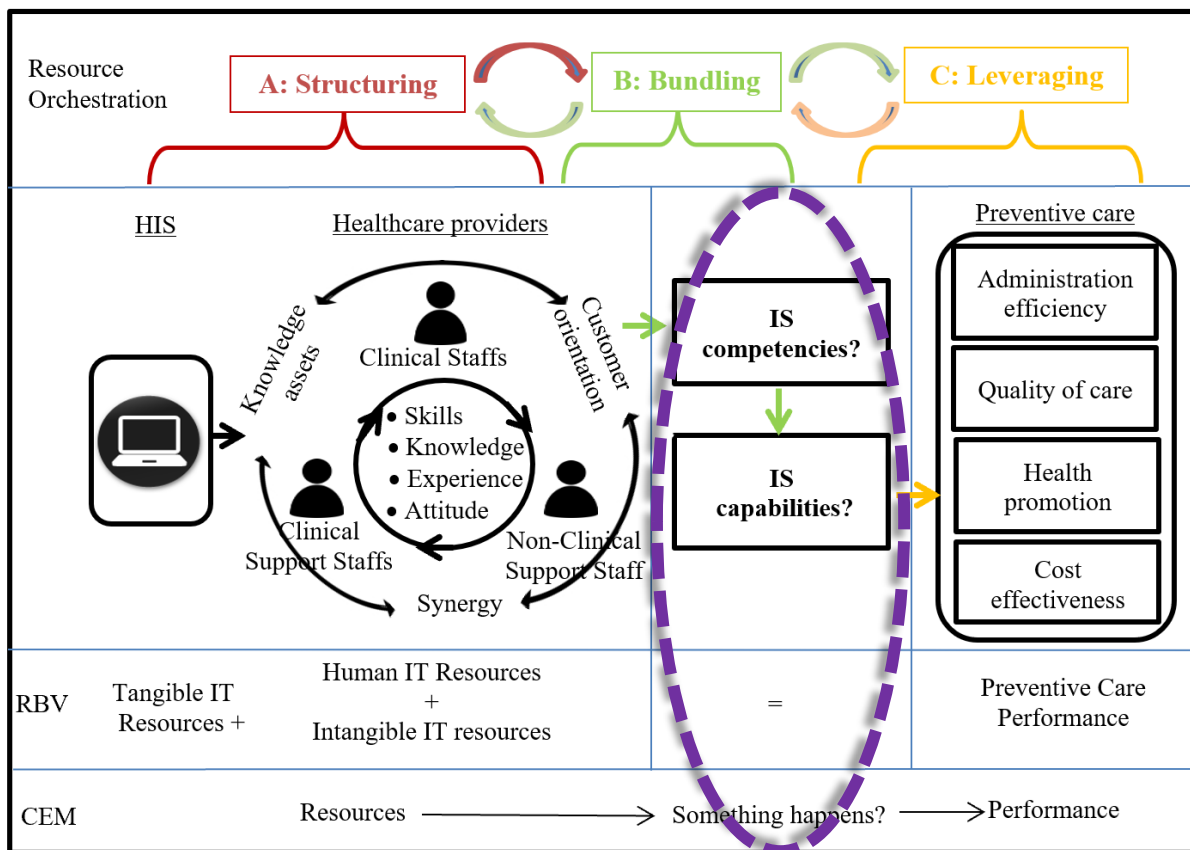


Figure 2.6: Conceptual model of IS competency and IS capability development

2.8.4.1 Resource structuring

The first process in the model is resource structuring. The purpose of this process is to form a resource portfolio for preventive care from relevant and limited resources. To achieve preventive care, a hospital needs to acquire and accumulate IS resources: tangible-IT resources, in this case the HIS; human-IT resources, which are the healthcare practitioners consisting of clinical staff (consultants, specialists, doctors, nurses), clinical support staff (dietician, pharmacists, physiotherapists) and non-clinical support staff (health-education officer) skills, knowledge, behavioural characteristics (Peppard & Ward 2004) and experiences (Ashurst, Doherty & Peppard 2008); and intangible-IT resources, which are knowledge assets, synergy and customer orientation (Bharadwaj 2000).

2.8.4.2 Resource bundling

The second process in the model is resource bundling. The purpose of this process is to integrate resources to develop IS competencies and capabilities. Once a hospital has structured its IS resources to form a resource portfolio for preventive care, these resources need to be bundled (Sirmon et al. 2011). The integration of these resources

will then create IS competencies and later develop IS capabilities (Peppard & Ward 2004). This will also help to prevent inappropriate use of these resources, as all available resources are bundled with a specific purpose. Within the bundling process, there are three sub-processes, stabilising, enriching and pioneering, as explained below.

1. Stabilising: the hospital can achieve improvements in its existing competencies. For instance, the nurses' skills and knowledge in using HIS enable them to systematically identify patients who are at risk, record their profile in the system, and generate a list of patients with chronic disease symptoms.
2. Enriching: the hospital can extend its current competencies to achieve preventive care. For example, the caretakers and nurses' experiences in using HIS, and attitude in providing quality health services to patients (customer orientation), enables them to establish an efficient smoking counselling service for patients with cardiovascular disease. For instance, with team care, they can improve their counselling practice by recording all delivered counselling and analysing the patient response patterns in HIS. Thus, the creation of a smoking counselling activity could improve the cardiovascular care process.
3. Pioneering: the hospital may develop new competencies for its preventive care. For example, the knowledge and experience among healthcare practitioners, which allow the development of knowledge asset and synergy, enables them to create new practices, such as placing reminders and referrals for smoking treatment (activity), for patients with cardiovascular disease. For instance, they can place their reminders among team members via HIS, before and after having discussions concerning a patient's smoking treatment or referring the patient to a specialist. This activity may provide a unique opportunity for healthcare practitioners to modify their previous treatment into a new effective cardiovascular treatment delivery.

2.8.4.3 Leveraging performance

The third process in the model is leveraging performance. The purpose of this process is to exploit IS competencies and capabilities to meet the unique needs of preventive care. When hospital IS resources have been successfully structured and bundled, they must be effectively leveraged to improve preventive care performance, including

administrative efficiency, quality of patient care, cost effectiveness and health promotion.

This conceptual model introduces a new concept as a paradigm shift for preventive care research. In this research, the proposed conceptual model shows that preventive care is not only confined to administration-related matters, but should also include quality of care (Frimpong et al. 2013; Krist et al. 2013), health promotion (Gullotta & Bloom 2003) and cost effectiveness (Probstfield 2003; Rezayatmand, Pavlova & Groot 2013). These four concepts of preventive care were defined and explained in Section 2.3.

The proposed concept is supported by past studies as it describes how administrative efficiency and quality of patient care are achieved with HIS. It allows healthcare practitioners to obtain critical patient information as soon as it is needed so that the healthcare specialist can quickly provide quality patient care (Frimpong et al. 2013; Krist et al. 2011). For example, cancer management is improved with the use of HIS through shared decision-making, symptom management and treatment (Bauer et al. 2014b; Clauser et al. 2011). Moreover, obesity surveillance can be improved using health data from HIS, as it helps to increase the timeliness and availability of relevant information about obesity in children and adults (Bauer et al. 2014b). Thus, administrative and quality of care are two important and interrelated concepts because they will determine the right treatment strategy to ensure patients receive the appropriate care (Shelley et al. 2011).

Another aspect is health promotion, which refers to a range of activities with the purpose of improving the health of individuals, groups and communities through general activities like health education, health communication and social activities (Gullotta & Bloom 2003). Previous studies have found that the effectiveness of various health-promotion methods in primary prevention is lacking, thus it becomes a challenge to reduce the incidence of chronic diseases (Golechha 2016). Therefore, health promotion is an important aspect of preventive care because it helps healthcare organisations increase knowledge and create awareness among the population, thus delaying the onset of chronic diseases (Srinivas & Paphitis 2016).

Cost effectiveness is also an important aspect included in the conceptual model to assess whether the resources used to provide preventive care services offer positive outcomes to benefit patients (Probstfield 2003). For instance, with the application of HIS, the healthcare organisation could potentially reduce hospital fees by increasing precision and improving disease-prevention initiatives (Tuckson 2013). Moreover, early identification and accurate treatment-related information, provided by HIS for individuals at risk of chronic diseases, could contribute to a reduction in the overall health system costs and improved preventive care (Clauser et al. 2011; Schade et al. 2015). Hence, the four preventive care concepts of administrative efficiency, quality of care, health promotion and cost effectiveness are presented in the conceptual model in the far-right box under the leveraging process (refer to Figure 2.6).

Thus, the purpose of this research was to develop the theoretical link between IS competencies and IS capabilities from IS resources using the resource orchestration perspective and the CEM as the theoretical lens to produce a model to illustrate the transformation process of IS resources, IS competencies and IS capabilities in achieving preventive care performance.

2.9 Conclusion

This chapter provided a comprehensive literature review that recognised the importance of preventive care as an important strategy to address chronic diseases, especially in developing countries. However, due to resource scarcity, preventive care is poorly delivered. Nevertheless, previous studies found that the use of HIS could improve preventive care delivery when it is integrated with other IS resources such as human-IT and intangible-IT resources. The integration of these IS resources was found crucial in that the integration results in the development of IS competencies and IS capabilities that become valuable resources to facilitate preventive care performance. Indeed, there is limited understanding about how IS competencies and IS capabilities are developed from the integration of IS resources and are leveraged to achieve preventive care. Whilst factors like cultural norms, digital divide, poverty and treatment pluralism are important, but they were not been included in the initial scope of the research because the research aim is on answering the main research question:

How does a hospital integrate resources that lead to information system competencies and information system capabilities in preventive care performance?

Therefore, this research attempted to address this deficiency by proposing a modified resource orchestration model as a theoretical lens to conduct a case study in the selected public hospital from one of developing countries; Malaysia.

In summary, the review of the literature supports the search for the answers to the main research question. This question is answered by breaking it down into the two following sub-questions:

What information system competencies and information system capabilities are utilised in preventive care?

How are information system competencies and information system capabilities developed in preventive care?

The next chapter describes the methodology employed to research the phenomenon of IS competency and IS capability development in preventive care.

CHAPTER 3 – RESEARCH DESIGN

As stated in Chapter 1, this thesis addresses the following main research question and two sub-questions:

How does a hospital integrate resources that lead to information system competencies and information system capabilities in preventive care performance?

1. What information system competencies and information system capabilities are utilised in preventive care?
2. How are information system competencies and information system capabilities developed for preventive care?

In order to address these questions, this chapter describes the methodology and design used in this research, dealing with issues relating to the philosophy and methodology while discussing the justification of choices made.

Section 3.1 describes the research philosophy, focusing on the soft positivist approach (Kirsch 2004). Section 3.2 describes the research methodology, which is qualitative. Section 3.3 outlines the research design strategy and also describes the steps taken to obtain ethics approval and the ethical considerations. Section 3.4 outlines the data collection methods, including the sources used to gather the data, while Section 3.5 elaborates on the data collection process, focusing on the interviews conducted at ABC Hospital. Section 3.6 explains the data-analysis procedures and methods. Finally, Section 3.7 explains the validity and reliability of the study.

3.1 Research philosophy

Each research philosophy contains different philosophical assumptions about reality and the nature of knowledge. There are three assumptions that should be considered to make research more thorough – ontology, epistemology and axiology (Sexton 2008).

First, ontology is an assumption that a researcher makes about the nature of reality (Sexton 2008). This assumption seeks to describe how the methodology a researcher

chooses can be influenced by people's view of reality and how they shape their lives (Corbin & Strauss 2008).

Second, epistemology is an assumption about how the world is viewed in reality; how one acquires and accepts knowledge about the world (Sexton 2008). From an epistemology standpoint, concepts and theories are socially constructed based on knowledge gathered from research participants who are trying to explain and make sense out of their experience or lives (Corbin & Strauss 2008).

The third philosophical assumption is axiology, which refers to an assumption about the nature of values, the foundation of the value judgements and whether the reality is value free or value driven (Sexton 2008). In value-free research, the research choice criteria are objective, whereas, in value-driven research, the research choice is determined by social actors' beliefs and experiences (Easterby-Smith, Thorpe & Lowe 2003).

These philosophical assumptions lead to the "soft positivism" or "scientific realism" (Kirsch 2004; Madill et al. 2000; Ravishankar et al. 2011). 'Soft positivism assumes that the phenomenon under investigation is relatively stable and objectively exists, which is consistent with a positivist view. However, the approach is not limited to examining preidentified constructs, but is designed to surface other constructs as well, in the manner of interpretivists or grounded theorists' (Kirsch 2004, p. 378). Thus, this research followed the soft positivism (Kirsch 2004; Madill et al. 2000; Ravishankar et al. 2011) in which the approach combines both positivist and interpretivist. This approach allows me to analyse the case data with certain expectations based on prior literature, while also allowing some unexpected findings and explanations to emerge from the data (Ravishankar et al. 2011). More specifically, consistent with a positivist view (Benbasat et al. 1987), I analysed qualitative data with expectations based on prior theories (Yin 2014) to understand how resources are integrated to develop IS competencies and IS capabilities in preventive care. At the same time, this research drew from interpretivists (Klein and Myers 1999; Walsham 1993, 2006) in allowing unexpected findings and explanations to emerge from the data (Ravishankar et al. 2011) when exploring the IS competency and IS capability development for hospital preventive care. Thus, the research question format and goals of the research point in a soft positivist direction (Kirsch 2004).

3.2 Research methodology

This research adopted a qualitative case study approach (Eisenhardt 1989) referred to as soft positivism (Kirsch 2004; Madill et al. 2000). The first basis of this research is positivist approach from Yin (2009) stating that the phenomenon studied – ABC Hospital and preventive care is a stable construct but further into the study it is expected that other concepts and relationships will be revealed and thus interpretive orientation (Klein & Myers 1999; Walsham 1993, 2006) are followed. Hence, soft positivism (Kirsch 2004; Madill et al. 2000) strengthen the conduct of the case study for the development of IS competencies and IS capabilities in preventive care.

Interpretivism is used for three reasons. First, this approach is valid and important to IS studies (Klein & Myers 1999) that explore the processes and development of IS resources in the preventive care area. Second, the interpretive paradigm enabled me to improve understanding of the IS context and the process that influences both IS and the context (Klein & Myers 1999; Walsham 1993). Third, having an interpretive paradigm helped me have close involvement with relevant individuals (Walsham 2006), in this case, the healthcare practitioners.

Many social scientific studies in the IS resource area use quantitative methodologies to, for example, assess the impacts of capabilities on organisations (Lu & Ramamurthy 2011), to measure the capabilities so they can be effectively utilised (Yoon 2011) and to identify the role of capabilities in an organisation (Chen et al. 2014). However, this research employed a qualitative approach to understand the meaning and context of the phenomenon studied (Maxwell 1996), which involved the exploration of IS competencies and IS capabilities used in healthcare fields from the view of healthcare practitioners.

The purpose of using the qualitative methodology in this research was, first, to establish the experiences of the participants and the processes involved (Merriam 2009) in using IS resources for preventive care outcomes. Second, a qualitative approach is helpful to study particular issues in depth in one or a few organisations (Myers 2013). Conducting a qualitative exploratory study in a single hospital, as this research did, provides the researcher with in-depth access to people, issues and data (Walsham 2006). Third, a qualitative approach is suitable when attempting to

understand the influence of social and organisational contexts on system use by examining the processes or mechanisms (Kaplan & Maxwell 2005), and developing explanations of the actual events and processes (Miles & Huberman 1994). Therefore, utilising a qualitative approach in this research assisted in the search for an explanation of the processes that link IS resources to preventive care.

3.3 Research design strategy – case study methodology

Given the complex and embedded characteristics of resources and capabilities, the exploratory nature of this research required the use of a *how* question (Yin 2016) and a need for the researcher to interact closely with relevant people in the organisation (hospital) to maximise the quality of data collected (Kamasak 2015). I, therefore, adopted a qualitative research design with a case study methodology, which provided close interaction with the healthcare practitioners (Eisenhardt 1989; Yin 2003). Additionally, case study research can be a valuable tool in healthcare service, which is less acknowledged in this area (Yin 1999).

Some researchers may describe Yin as positivist (Yazan 2015), and others say he is constructivist (Baxter & Jack 2008); however, Yin does not make any statement in his texts about his philosophical orientation – either positivism or constructivism. Despite some describing Yin as a positivist researcher, ‘his view that case studies are the preferred research strategy to answer “how?” and “why?” questions would also be accepted by the interpretive school’ (Walsham 1995, p. 74). Moreover, Denzin and Lincoln (2005 p. 7) state that, ‘nor does qualitative research have a distinct set of methods or practices that are entirely its own’. Therefore, I believe that Yin’s work is in line with the soft positivist view of this research. Thus, for this research, I borrowed some of Yin’s case study methodology. I also borrowed some of his work on systematic steps of analysis phase (see Section 3.6), which provided me with a structured process in managing the research data, and analysing, developing and interpreting themes. Thus, adding some of Yin’s (2016) work in the analysis phase of this research guided me to perform data analysis systematically; ‘case study practice can be dramatically improved by applying what is already known’ (Yin 1981, p.63).

This research involved a single case study within a public hospital based in a developing country. This was deemed the most appropriate in light of the aims of the

research – to understand the mechanism that transforms IS resources towards preventive care performance – due to the close interaction with practitioners as a tool to get an inside view (Walsham 1995), to provide description, and generate and test theory (Eisenhardt 1989; Gibbert, Ruigrok & Wicki 2008; Saunders, Lewis & Thornhill 2003; Yin 2003). Doolin (1996, p. 25) notes that ‘single case studies allow in-depth analysis of one setting with regard to a large number of aspects, allowing a broad and detailed analysis of organisational dynamics, and the production of the rich descriptions favoured by interpretive researchers’. A single case was deemed suitable for this research as my intention was to explore this one unique case to create a framework that could be used in turn to test other environments (Bennett 2004). Moreover, a single case could be used to understand how things work and to obtain findings that would be informative of the complex situation with the ‘priorities on uniqueness and on context’ (Stake 2010, p. 27). While the results from a single case are not generalisable to the population from a statistical or general viewpoint, the results can be considered to support theoretical propositions (Yin 2016). Thus, I hope this exploratory case study lays the ground for further research regarding IS resources and preventive care performance relationships. The selection of the case was based on the research of Pan and Tan (2011) and Yin (2003), allowing an in-depth examination of contemporary phenomenon such as how a healthcare organisation utilises IS resources to generate preventive care.

For this research, I needed some preliminary theory and theoretical propositions or research questions related to the topic to serve as a blueprint and ensure that this research moved in the right direction (Yin 2014). The use of RBV theory, Davis-Sramek, Germain and Krotov’s (2015) CEM, combined with Sirmon and colleagues’ resource orchestration perspective (Sirmon et al. 2011) and a research question in the early stages of this case study are important for three reasons.

First, an initial theory provided relevant constructs that led to the searching of relevant information for a literature review on preventive care. The information from the literature review was then used with the background information gathered on ABC Hospital to develop a mental concept for the research (Pan & Tan 2011).

Second, the theoretical proposition reflects the research question, which in turn provided a basis for the case study objectives and its design (Yin 2014). Furthermore,

the role of preliminary theory is to guide the collecting and organising of initial data (Pan & Tan 2011; Walsham 1995) and identifying relevant information to be collected during the data collection process to avoid the possibility of including irrelevant information about the case being studied (Yin 2014).

Third, the initial theory and theoretical proposition used in this research helped me organise the case study data. The constructs from the initial theory and proposition were used as a theoretical lens to analyse and elaborate on the data (Pan & Tan 2011; Yin 2014). Although the role of the initial theory in this research is to support the data collection and analysis phase, researchers have the option to modify and adjust the theory according to the results of the data (Walsham 1995). This is because flexibility in applying the theory assists in expanding the initial theory and perspective (Walsham 1995), thus supporting the construction of theory. Chapter 5 presents the revised theoretical framework, which is the final product from the case study (Walsham 1995).

3.3.1 Case selection

This research focused on a healthcare organisation in a developing country, ABC Hospital, that provides preventive care, by using its HIS. This case was determined based on several criteria. First, I needed an organisation that had implemented preventive care. ABC Hospital has initiated many aspects of preventive care. The hospital has built preventive care in each of its care services to address chronic disease problems. As a health referral centre, ABC Hospital provides secondary and tertiary levels of preventive care with its speciality services. Additionally, primary prevention in this hospital plays an essential role in supporting both the secondary and tertiary levels of prevention. Hence, its experience in delivering preventive care provided me with an interesting case to explore the integration of IS resources for preventive care.

Second, the organisation is a leading public hospital with a long history in HIS usage. Thus, the complex structure of its administrative and operational processes provided rich research data. It is unique because the hospital is equipped with a fully integrated IS, known as THIS, which includes a highly-integrated group of applications that cover clinical, financial and administration systems. Furthermore, the maturity level in HIS usage dictates that ABC Hospital has experienced healthcare professionals with IT

skills and knowledge, particularly in delivering preventive care services. The use of HIS enables more flexible and fluid structures for hospital processes, such as creating a variety of options for healthcare practitioners in assessing information and connecting to different staff in the hospital. Thus, the maturity of HIS in ABC Hospital allowed me to better identify and theorise about the mechanisms responsible for the integration of its IS resources for improving preventive care.

Third, ABC Hospital is also a large specialist hospital with a number of employees with specialist skills. These experienced healthcare practitioners have access to a knowledge base and are exposed to the hospital's needs and solutions. Having healthcare practitioners who are masters of the complexities of specific solutions provided a base for this research to determine the IS competencies and IS capabilities for preventive care.

Fourth, the working environment at ABC Hospital is entirely different from a conventional hospital in Malaysia. The hospital culture shapes the way healthcare practitioners work and contributes to the advanced experience of its staff in delivering services through the use of HIS and its other resources. For example, all its healthcare practitioners and other employees are given access to the system. This accessibility enables them to share and exchange information effectively among all the functional units in the hospital. These unique properties distinguish ABC Hospital from others (Hannah & Ball 2004). In summary, there is no other hospital in Malaysia that fits within the above criteria as well as ABC Hospital.

As well, as ABC in Malaysian being a unique case, the researcher's own experience and interest in this country has allowed the researcher to bring along their own insight and richness into the case .

Therefore, this hospital's rich and complex experiences in using HIS, effort in delivering preventive care, expertise and working environment made a compelling case for understanding the phenomenon from a qualitative perspective (Yin 2003).

3.3.2 Unit of analysis – the case

This case can be defined as a single unit, or a bounded system (Merriam 2009). Miles and Huberman (1994, p. 25) suggest that the case is 'a phenomenon of some sort

occurring in a bounded context'. They present the case as a circle with a heart in the centre, as depicted in Figure 3.1. The heart represents the focus of the research and the circle 'defines the edge of the case: what will not be studied' (Miles & Huberman 1994, p. 25). In other words, this describes the scope of the research. Miles, Huberman and Saldana (2014, p. 28) point out that 'the case is, in effect, your unit of analysis'.

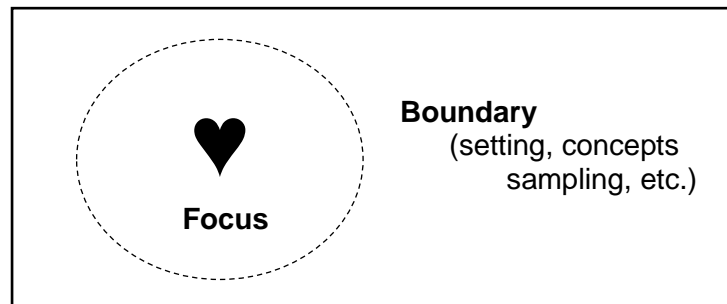
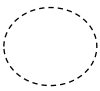



Figure 3.1: The case as the unit of analysis (Miles & Huberman 1994)

In this thesis, the case is defined using two essential categories – the boundary system and the focus of research, as shown in Table 3.1. First, the case is defined by the organisation, a Malaysian public hospital that provides preventive care for chronic disease service, with other boundary aspects. The boundary is the aspect or major context of the case that the researcher can study (Miles, Huberman & Saldana 2014). For example, in order to resolve the research question in this research, the boundary or scope was set to include only the hospital's employees (the healthcare practitioners) and the hospital site itself. To remain within this boundary, I did not interview the hospital's patients or the healthcare practitioners' family members. The boundary connects directly to the research question (Miles, Huberman & Saldana 2014) and also can be defined by sampling. Second, within this case is the focus of the research, which is similar to an embedded unit of analysis suggested by Yin (2014). The focus of this research was the development of IS competencies and IS capabilities in preventive care of chronic diseases, serving as an example of how the hospital's IS resources influence its preventive care.

Table 3.1: Defining the case/unit of analysis (using the approach of Miles & Huberman 1994; Miles, Huberman & Saldana 2014)

Category	Symbol	Description
Boundary		A Malaysia public hospital that: 1) provides preventive care for chronic disease services 2) is equipped with HIS Hospital employees who are related to the preventive care service Hospital site (departments approved by the director of the hospital)
Focus of research		The development of IS competencies and IS capabilities of preventive care of chronic diseases in the public hospital

Note: HIS = hospital information system; IS = information system

The identification of interview participants for this research was based on purposive sampling. Using purposeful sampling means the participants can ‘yield the most relevant and plentiful data – in essence, information rich – given your topic of study’ (Yin 2016, p. 93). There are several types of purposive sampling, but this research uses the snowballing technique and voluntary participation (Merriam 2009; Yin 2016). This research used the term *participants* to refer to ‘individuals being studied’ (Merriam 2009, p. 162), while *informant* refers to a person who can provide ‘insights into a matter’ and assist in getting ‘access to other interviewees’ (Yin 2014, p. 111).

The purposive sample was drawn from the healthcare practitioners who are related to the preventive care field, and their participation was voluntary. The sample needed to be healthcare practitioners involved in a preventive care service from a specific public hospital. Also, research that involves MOH institutions such as public hospitals and human subjects must follow the National Institute of Health (NIH) guidelines and policy statement, and be reviewed and approved by the Medical Research and Ethics Committee (MREC) Malaysia.

I also used snowball sampling to find other possible persons who could be interviewed (Merriam 2009). For example, the gatekeeper acted as an informant who provided information and recommended a few possible participants who could contribute to the rich information related to the research topic. This information provided by the key informants led me to possible participants, as well as documents to read and gather (Merriam 2009).

These strategies for selecting participants were appropriate for this research for two reasons. First, the sampling design can ensure information is gained that is accessible only from specific groups of people (Sekaran & Bougie 2010); in this instance participants involved in the preventive care area. Second, the sampling approach can provide rich and relevant information to answer the research question (Bailey 2007; Merriam 2009; Yin 2016). For instance, the selection of the participants may contribute to the development of insights and understanding of the phenomenon studied (Merriam 2009); that is, to understand the integration of IS resources to develop IS competencies and capabilities for preventive care. Therefore, the participants who can reflect the purpose of the research and guide an information-rich case (Merriam 2009) are specialists, doctors, nurses and other related personnel.

Pan and Tan (2011) suggest that the number of individuals to be interviewed should be a minimum of 15, with no repeat participants, to represent a variety of voices. I planned to interview 25 participants to ensure the provision of rich information for the research until theoretical saturation is achieved (Pan & Tan 2011). The number of participants and sufficiency of data is further elaborated in Step 5 of the case study procedures, in Section 3.3.5.5.

3.3.3 *Recruitment process for participants*

The process of recruitment of participants for this research included several steps. First, official permission from the hospital director and NIH Malaysia was granted for conducting this research and interviews. Second, the gatekeeper suggested the specific department to be studied for this research. Third, the gatekeeper advised staff to contact me if they were personally interested and would like to volunteer. This meant participants could opt-in rather than opt-out, and only I would know the final participants, with the participants' identities kept confidential throughout the research.

3.3.4 *Ethical considerations*

This research was reviewed and approved by the Human Research and Ethics Committee, RMIT with the notice of approval letter on 15 March 2016 (refer to Appendix 6). Participants were informed that their participation was voluntary. A gatekeeper was identified to assist during the scheduling of interviews. Prior to the

case study being conducted, any research that involves the institutions under MOH, Malaysia, required me to register with the NMRR, Malaysia, after approval was received from the director and head of department of the selected hospital. The MREC, Malaysia, issued approval on 29 April 2016 after the ethical application was submitted online and reviewed (refer to Appendix 7).

The selected hospital was informed of the approval from MREC, and several follow-up calls and emails were made to the gatekeeper to confirm the interview sessions planned. The consent form (see Appendix 8), interview guides and completed interview questions were provided to the gatekeeper to be distributed to the participants before the interviews were scheduled (refer to Appendix 9).

After obtaining official permission from the hospital director and NIH, Malaysia, preparation for an on-site visit to Malaysia was planned. Through phone calls from Melbourne, the meeting was set with the gatekeeper to confirm and discuss suggested departments. The gatekeeper advised that further discussions should be made when I visited the site in Malaysia. The first meeting with the gatekeeper was organised on 3 August 2016 at the gatekeeper's office in ABC Hospital. At the meeting, a few things were discussed, including the procedures that should be followed when research is conducted at the hospital.

A few more follow-up meetings and discussions were held with the gatekeeper to gain access to the departments. With permission obtained from the head of departments and approved by the hospital director, access was gained to the departments and participants. The interview sessions were held from August 2016 to March 2017 at the selected hospital.

3.3.5 Case study procedures

The conduct of this case study was based on an adapted the SPS approach (Pan & Tan 2011) as presented in Table 3.2 and expanded on in the following sections. The SPS approach provides systematic prescriptions of eight steps for the conduct of case study. The SPS approach represents *structured* in which it details eight steps, *pragmatic* in which it introduces techniques that are workable and balanced with

academic rigour and *situational* in which it provides techniques for handling surprising data.

I used the SPS approach for several reasons. First, it provides a step-by-step process for the entire research process in the form of detailed instructions on the conduct of case research. Second, this approach is workable because the steps are presented procedurally to facilitate the less experienced researcher. Third, this approach explains how flexibility in a research setting can be achieved, for example by reading about theories before the data collection process takes place, so that the researcher has a better idea about the theoretical constructs that can be used in the data collection process. Additionally, the work from Yin (2016) on five analysis phases, Saldana (2013) on coding techniques, and Miles, Huberman and Saldana (2014) on a table of matrix display were added in the analysis phase of the SPS approach to provide me with a systematic way to develop and interpret themes.

Table 3.2: Adapted structured-pragmatic-situational approach to conducting case studies (Pan & Tan 2011)

Step	Process
1	Access negotiation Determine interesting case, the objectives, the resources, and an influential gatekeeper, and obtain ethics approval from RMIT & MREC Malaysia
2	Conceptualise the phenomenon Includes the use of secondary data collection (reviewing the non-technical literature and read different theories); use the constructs to design the interview questions
3	Collecting and organising initial data Perform the initial data collection; break data into themes, examine and compare for similarities and differences, using some part of the work of Yin (2016) on analysis phase and Saldana (2013) coding technique to find themes
4	Constructing and extending the theoretical lens Select a guiding theory, break it down into its constructs to create a set of categories for the initial theoretical lens; refine the mental concept of the phenomenon (the development of IS competencies and IS capabilities) and collect more data
5	Confirming and validating data Ensure sufficient data – minimum of 15 interviews; use triangulation to ensure data validity by cross-checking and querying the same participant several times; create a database; establish case study protocol
6	Selective coding Use narrative strategy to summarise data collected into a story, filling gaps with new additional information; support with tables and figures; use Yin (2016) five analysis phases to support the analysis procedures, Saldana's (2013) in-vivo and holistic coding to assign codes to the data and Miles, Huberman and Saldana's (2014) tabular device to manage qualitative data, finding themes and interpret the meanings.
7	Ensuring theory-data model alignment Can the theory explain the data? Can the data fit into the model? Can the model represent what happens?
8	Writing the case report

Note: MREC = Medical Research and Ethics Committee; IS = information system

3.3.5.1 Step 1: Access negotiation

I negotiated access with the director of ABC Hospital, who agreed to the formal emailed letter and gave permission for this research to be conducted in the hospital setting. During this step, a compelling case was determined (preventive care), the objectives were clarified, the resources required for the data collection were planned, and an influential gatekeeper was identified to assist scheduling the interviews. Prior to the case study being conducted, any research that involves institutions under MOH, Malaysia, requires researchers to register with the National Medical Research Registry (NMRR), Malaysia. After approval from the director and head of department of the selected hospital, the ethical application was submitted online and reviewed by the MREC, Malaysia, which issued its approval. The selected hospital was informed about the approval by the MREC, and several follow-up calls and emails to the gatekeeper confirmed the planned interview sessions.

3.3.5.2 Step 2: Conceptualising the phenomenon

Step 2 conceptualised the phenomenon, which was to understand IS competencies and capabilities from the point of view of healthcare practitioners. This step includes the use of secondary data collection by reviewing the non-technical literature and reading widely on the different theories to search for suitable theoretical lenses. From a theoretical perspective, a few theories were analysed (refer to Section 2.7 for details) and as a starting point, I read about RBV theory to understand the characteristics of resources and the link they have with performance. However, the limitations of the RBV in explaining the connection between resources and performance led me to consider a combination of the resource orchestration perspective of RBV and the CEM, which eventually became the primary theoretical lens for the research. The constructs from the potential theories and theoretical lens were used to design the interview questions.

3.3.5.3 Step 3: Collecting and organising initial data

I performed initial data collection to validate the perspective of the development of IS competencies and capabilities for preventive care. The consent form, interview guides and completed interview questions were provided to the gatekeeper to be distributed to the participants before the interviews were scheduled. The interview sessions were held in August 2016 at ABC Hospital. After the interviews were held, I used open

coding to facilitate the theorising effort in which data were broken down from the initial interviews into the category of themes. Section 3.4 discusses these data collection methods in detail.

3.3.5.4 Step 4: Constructing and extending the theoretical lens

Step 4 comprised the preliminary stage of theory building. The initial data were analysed and compared with the literature on resources, competencies and capabilities as well as preventive care. Furthermore, at this stage, I selected the RBV (Barney 1991), resource orchestration perspective (Sirmon et al. 2011) and CEM of ‘resources → something happens → performance’ (Davis-Sramek, Germain & Krotov 2015, p. 247) as a guiding theory and perspective. This theory was organised into its component constructs and propositions to create a set of categories that become the initial theoretical lens. Table 3.3 illustrates the categories of the initial research lens, which is in the left column. The empty right column is for supporting evidence to be completed after completion of the analysis from the initial interview at Step 3.

Table 3.3: Theoretical lens constructed from the resource orchestration perspective (Adapted from Pan & Tan 2011)

Category	Supporting evidence
1. Structuring IS resources (Tangible-IT, Human-IT, Intangible-IT resources)	
2. Bundling IS competencies and IS capabilities (Stabilising, enriching and pioneering)	
3. Leveraging performance (IS capabilities towards preventive care performance)	

Note: IS = information system; IT = information technology

During Step 4, I used the initial lens to guide later iterations of data collection and analysis. As a result, the mental concept of the phenomenon, which is the development of IS competencies and capabilities for preventive care, was refined, initial themes, interview questions and topics were adjusted, and more data were collected. I held the follow-up interview sessions in February 2017. Steps 2 to 4 continued in the framing cycle until it reached theoretical confidence. Theoretical confidence is the state where, using the theoretical lens, the case data were able to

represent the empirical reality and provide an adequate contribution to the theory and practices.

3.3.5.5 Step 5: Confirming and validating data

The augmenting cycle started with Step 5, confirming and validating data to achieve two objectives; first, to ensure sufficient data and second, to ensure its validity using triangulation and a few other techniques. Section 3.7 further elaborates the techniques used in this research to ensure the validity and reliability of the data.

Regarding the first objective of achieving sufficient data, Pan and Tan (2011) suggest a minimum number of interviews (15, with no repeat participants) to represent a variety of voices. To ensure sufficient data is difficult (Pan & Tan 2011), as 'there are no rules for sample size in qualitative inquiry' (Patton 2002, p. 244) and there is no answer to how many people to interview (Merriam 2009). Considering several factors; such as the scope and timeframe of the research (Pan & Tan 2011), as well as the complexity of the research topic, and the depth of data required from participants (Yin 2016), I conducted 40 interviews with 20 follow-up interviews. This number of interviews is considered sufficient when the saturation point is achieved and no new information can be added to the existing data (Merriam 2009). In addition, the interviews were conducted with different healthcare practitioners to avoid a 'dominant voice' of participants, thus ensuring an unbiased report (Pan & Tan 2011, p. 169).

Moreover, I collected secondary data such as hospital reports, bulletins, working papers and handbooks to complement the information gathered from the interviews. Sufficiency of data collected was achieved when little new information was received from additional participants (Yin 2016). This is a common strategy in qualitative research, known as sampling until a point of redundancy or saturation is reached (Lincoln & Guba 1985).

I was given access to two clinical departments, surgical and ophthalmology, and three non-clinical departments, a dietetic unit, physiotherapy unit and health-education unit. Saturation was reached when I had interviewed someone from almost every role in the department, and nothing new was learned. In addition, I talked with a few senior healthcare practitioners who had been working with ABC Hospital since it started, who confirmed that I had correctly understood the complex preventive care patient

processes and the development of IS competencies and IS capabilities in the preventive care area.

3.3.5.6 Step 6: Selective coding

Selective coding is the process of filling in the theoretical lens with at least two sources of data. The process uses a narrative strategy to create 'a detailed story from the raw data' (Langley 1999, p. 695) and to add new additional information that comes from each iteration of the augmenting cycle (Pan & Tan 2011). The narrative strategy was also supported with visual formats, such as tables showing a matrix display (Miles, Huberman & Saldana 2014) and logic models (Yin 2014) which provided more structure and detail in managing the qualitative data. The logic models used in this research operationalised the events taking place in ABC Hospital. Also, it reflected the research question as well as the research theory and perspective. The flow of figures in the logic model helped me fill in new findings and identify which part of the model required more data to answer the research question. Next, the matrix display allowed me to present information in a systematic way because it allowed considerable information to be presented and arranged coherently to obtain patterns and themes, thus enabling me to draw and verify conclusions for the research (Miles, Huberman & Saldana 2014). Section 3.7 explains these analytic techniques for case study analysis and are presented in Appendix 10 for logic models and Appendix 11 for the matrix display.

3.3.5.7 Steps 7 and 8: Ensuring theory-model-data alignment and writing the case report

The augmenting cycle finishes with Step 7, ensuring theory-data model alignment, and Step 8 completes the case research by writing the case report. In Step 7, the emergent model is compared with existing theory and data. This process is iterative; if the models are unable to explain the data, they should be modified. If the data point to a new type of resource development, the models should be re-evaluated and updated. For example, the data analysis showed that the development of IS resources happened in two different resource bundling cycles, not just one. The process of resource formation revealed new insights into how IS resources are integrated and developed into IS competencies and IS capabilities for preventive care. In addition, the new insights enabled me to continually update the emergent model to then

compare whether the existing theory and perspective supported the emergent model. Hence, with this step, researchers can demonstrate whether the emergent model is consistent with empirical data and existing theory in the literature. Additionally, the initial theoretical model developed from this research was validated through peer-reviewed conference in the form of reviews, presentations and key informants in the healthcare organisation (Merriam 2009). The framework presented in Chapter 5 of this thesis transformed from a simple version to its current modified form (refer to Figure 5.1 in Section 5.1), in a collaborative effort between me and my supervisors, the healthcare practitioners and academics in the field of IS.

The writing of this thesis (i.e. Step 8) closely followed the highly structured format suggested by Pan and Tan (2011) to establish a clear chain of logic, especially in reporting the case study. However, the only difference was that this thesis has a slightly different format in that it has seven chapters with a separate chapter for the case description, whereas Pan and Tan suggest six chapters, with the case description and the case analysis placed in one chapter. Nevertheless, they state that format variations could exist when reporting the case.

3.4 Data collection methods

The data collection methods used in this research were interviewing, collecting and examining. The interview was the major source for collecting data to understand the development of IS competencies and capabilities for preventive care. Interviews were an essential source of evidence for this case study because this research involved interaction with healthcare practitioners to understand their actions towards the development of the IS resources to preventive care outcomes (Yin 2014, 2016).

Conducting interviews enabled me to gather information from healthcare practitioners about their experiences using IS resources in preventive care and determine other relevant sources of evidence that could be used (Yin 2014). However, using interviews as a data collection method is subject to common problems such as bias, poor recall, and inadequate and inaccurate articulation. Thus, interviews were corroborated by other sources (Merriam 2009; Yin 2014, 2016). Table 3.4 lists the corroborative sources used.

Table 3.4: Sources of evidence – strengths and weaknesses - Adapted from Yin (2014)

Source of evidence	Strengths	Weaknesses
Documentation	Stable – can be reviewed repeatedly Unobtrusive – not created because of the case study Specific – can contain the exact names, references, and details of events Broad – can cover a long span of time, many events and many settings	Retrievability – can be difficult to find Biased selectivity, if the collection is incomplete Reporting bias – reflects (unknown) bias of any given document's author Access – may be deliberately withheld
Archival records	Precise and usually quantitative	Accessibility due to privacy reasons
Interviews	Targeted – focuses directly on case study topics Insightful – provides explanations as well as personal views (e.g. perceptions, attitudes and meanings)	Bias due to poorly articulated questions Response bias Inaccuracies due to poor recall Reflexivity – interviewee gives what interviewer wants to hear
Field notes	Nonverbal source Reflective- assist researcher to think and identify useful information	Fragmented and incomplete Time needed to write up the notes

3.4.1 Documents

Documents were used in this research for several reasons. First, documents such as hospital handbooks are helpful in verifying the correct spellings and titles or names of people and departments in the hospital mentioned in an interview. Second, documents can provide other specific details to corroborate information from other sources. For example, the interview data was verified by checking hospital bulletins. Third, documents can be used as inferences for clues to undertake further investigation. For instance, the hospital websites, advertise education classes for diabetic disease. With this information, I was able to search for potential participants and arrange for interviews. Apart from an internet search, an arrangement was made to access and review files and documents of the hospital (Yin 2014). For example, permission was obtained to review files at the ABC Hospital's Education Unit and Secretariat Quality Unit. However, some precautions must be taken in reviewing the documents because some of the documentary evidence reflects other parties' efforts to achieve other objectives (Yin 2014). Therefore, by continually trying to identify the objectives, research benefits from the content and avoids any misleading information and over-

reliance on documentation evidence (Yin 2014). Thus, the effort of interpreting the contents of the documents correctly is critical.

3.4.2 Archival records

I used archival records and documentation in conjunction with other sources of information such as annual hospital reports that contain organisational charts, the number of departments and survey data, and minutes of meetings. For example, an arrangement was made with the Secretariat Quality Unit in ABC Hospital to access and review the hospital standards and procedures and hospital survey data on healthcare practitioners' satisfaction. I triangulated the data analysed with the evidence from the information documented in annual reports and minutes of meetings.

3.4.3 Interviews

I used a semi-structured interview method for several reasons. First, the interview guide included a mix of more and less structured interview questions (Merriam 2009), allowing for flexibility to change and add possible relevant questions that were not strictly scripted (Yin 2016). Second, this method does not follow word usage or phrases directly; rather the prepared questions are more flexibly worded. This method allows researchers to respond to the situation at hand to the participant's view, and to the new ideas on the phenomenon studied (Merriam 2009). The sample of interview questions is provided in Appendix 9.

To accommodate participants' common conversation language in Malaysia, which can be English, Malay or sometimes mixed, the interview questions that were in English were also prepared in Malay. I used a combination of back translation with the bilingual technique suggested by Brislin (1970) as an approach for instrument validation. This meant that the instruments were translated into the target language by a bilingual expert and blindly back translated by the next bilingual expert. The back-translated versions were compared with the original (source language) versions and re-translated where errors in meaning were found. The process continued until congruence of meaning between the original and target versions in Malay was reached. To develop an easily understood Malay version of the instruments involved three bilingual individuals. They produced a translation that used conversational Malay.

This research used a back-translation technique, compared the original and second-source versions of the instrument, and tested both source and target-language versions among bilingual subjects administered by the bilingual judge (Jones et al. 2001). Other methods, such as the committee approach, requires more than three bilingual people, and the accessibility of bilingual people as translators is a vital issue in this approach (Cha, Kim & Erlen 2007). Moreover, previous studies recommend multiple techniques should be used for instrument translation (Maneesriwongul & Dixon 2004). This is because previous studies found no standard guideline for instrument translation, and the quality of processes used for instrument translation varies widely among researchers (Cha, Kim & Erlen 2007; Maneesriwongul & Dixon 2004).

Thus, I selected a combination of back translation and Brislin's (1970) bilingual approach because of its benefits and some other factors that fit the research. The key benefit of conducting a combination of Brislin's (1970) back translation with the bilingual technique is that it allows for comparison of the source-language version with the version that is back translated into the source language. The bilingual technique is used to test the validity of the instruments on the bilingual subject (Maneesriwongul & Dixon 2004).

Moreover, I selected these techniques after considering several factors: first, the availability of three bilingual translators; second, the availability of the administrators and bilingual subjects who are required to check and review the instrument so that it is within the field of research and are tested to the subjects; and third, the translation required budget and time to complete the instruments.

I had difficulty finding a bilingual translator knowledgeable in the field of research. To address the problem, two administrators, or bilingual judges, were selected. A bilingual judge can make a rigorous comparison between the source and target language (Maneesriwongul & Dixon 2004). The administrator or judge is a person who is knowledgeable about the field of research. The first administrator reviewed the Malay (translated) version and the source (English) version to ensure the meaning of the words and sentences could deliver the research objectives. The second administrator was a retiree with vast experience working in a public health institution. Her role was

to help review the translated Malay version and its back translation (to English) to ensure the meaning in Malay was in line with the healthcare environment.

Some problems regarding the translation were detected and solved. First, there are words that have many meanings when translated into Malay. For example, the word *use* can be defined as *apply* or *practice* in English, but when translated into Malay, *use* can be known as *wear (pakai)*, which does not make sense. Therefore, words had to be carefully chosen to give the most accurate meaning when used in a sentence in the research. Moreover, after discussion with Administrator 1, several words were used instead of one, so the right meaning was provided (Cha, Kim & Erlen 2007). Second, some terms are difficult to translate into Malay. For example, the term *bundling*, *leveraging*, *administrative efficiency* in the interview question were also difficult to translate to mean the same as in English. This problem was solved by translating the terms into a few words, defining them and placing them in a glossary. The administrator then reviewed the terms in discussion with Translator 2 to ensure they still reflected the meaning within the context of the research (Cha, Kim & Erlen 2007).

The translation was conducted by three qualified bilingual experts and two administrators. Translator 1 is a professional translator with more than 15 years experience working as a translator. She is a certified translator who is a translator for a company. Translator 2 received English education from an established university in Malaysia, and has 25 years' experience communicating in English and Malay. Translator 3 has vast experience communicating in English and Malay. She obtained her college education in Malay and furthered her degree in an English university. She has almost 25 years' experience in teaching English and Malay in high schools and private companies, and is familiar with Malaysian culture. She is a native speaker of Malay and an expert user of English. Administrator 1 was educated abroad, where she lived for more than 10 years. She speaks English and is fluent in Malay. Administrator 2 is a retiree from a public health institution. She has more than 20 years' experience working as a healthcare practitioner. She speaks Malay and is fluent in English.

Figure 3.2 shows the steps involved during the translation process, adapted from Jones et al. 2001. Translator 1 translated the interview questions from English to Malay (Step A) and then Translator 2 blindly translated them back to English (Step B).

Administrator 1 then reviewed this back-translated version in discussion with Translator 2 to check for any differences in meaning between the two English versions (Step C). They resolved any differences by referring back to the Malay version as originally translated in Step A. This achieved the most culturally equivalent meaning and resulted in a revised Malay version. In Step D, Translator 3 independently translated the revised Malay version back to English. Administrator 2 then reviewed this next back-translated English version in discussion with Translator 3 (Step E). This process continued until the bilingual experts, and I agreed on the equivalent meaning in the source- and target-language versions of the interview questions. A final revised version of the questions in Malay was produced, and Step F proved validity by testing for reliability and equivalence using a sample of bilingual subjects.

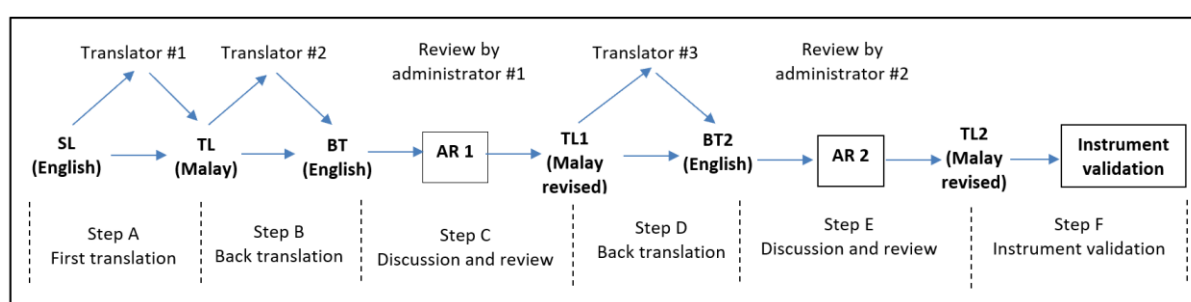


Figure 3.2: Instrument translation model (adapted from Brislin 1970; Jones et al. 2001)

Note: SL = source language; TL = target language; BT = back translation; AR = administrator review

3.4.4 Field notes

Other than documents, archival records and interviews, I also used field notes as a nonverbal source of evidence produced when doing an interview (Merriam 2009; Yin 2016). After each interview, I converted the field notes into a fuller note. The field notes could be fragmented and incomplete (Yin 2016); however, they are important because they included my initial interpretations and thoughts about the interviews conducted (Merriam 2009). Moreover, the field notes were useful for me to think about and reflect on the events that happened during the interview and to identify any interesting and useful information (Yin 2016). Additionally, the field notes helped me prepare for the next interview session (Yin 2016). Figure 3.3 provides an example of my field notes.

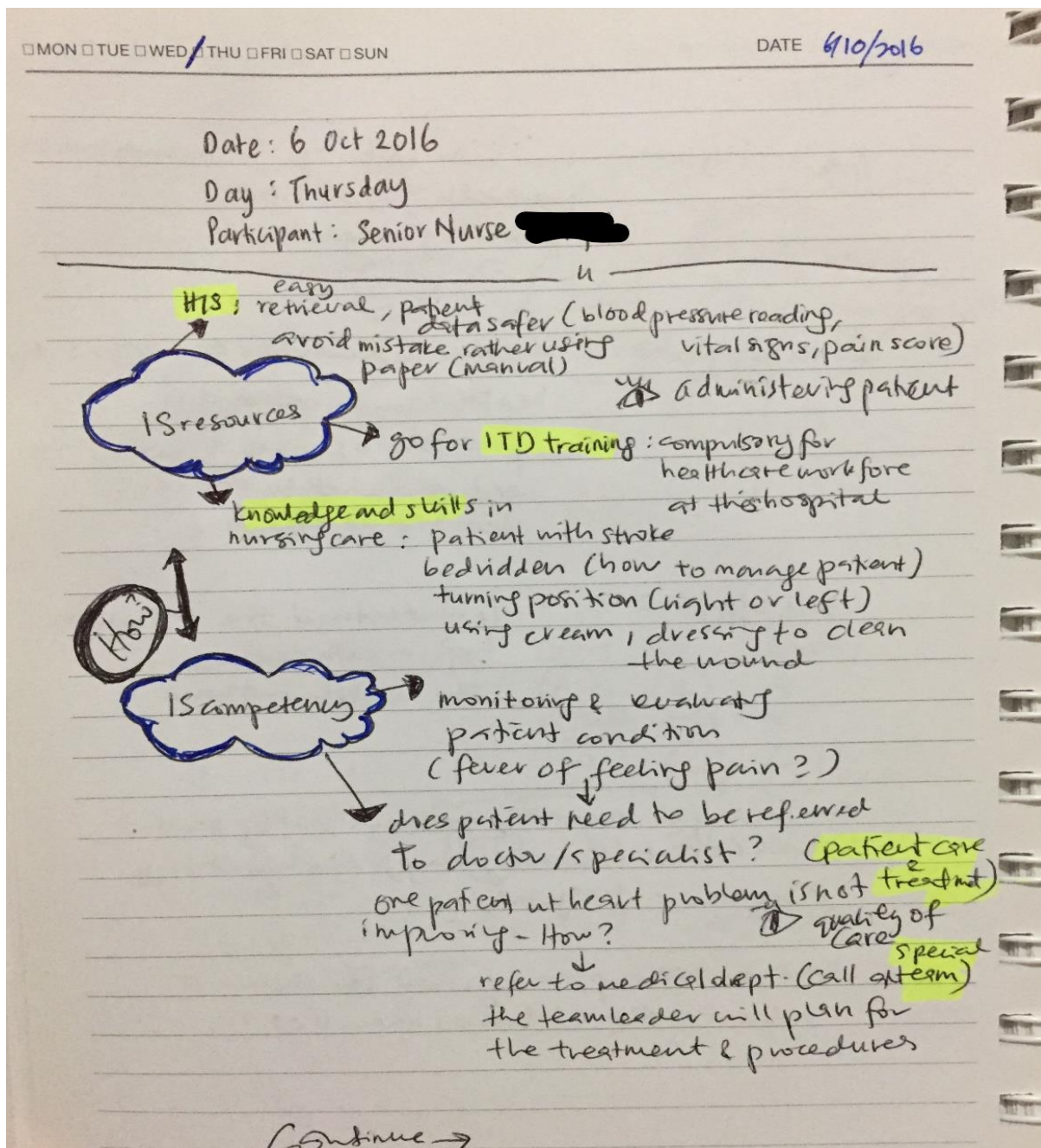


Figure 3.3: An example of field notes

3.5 Data collection process

The procedure for the qualitative research for this thesis comprised the process of identifying and approaching the respondents, the interview schedules and protocol, and the data collection process.

3.5.1 *Identifying and approaching the interview participants*

This research used the interview as the primary source of data collection. Collecting data through interviews requires the researcher to determine whom to interview (Merriam 2009). First, I contacted the gatekeeper, (the deputy director from the Clinical Research Centre (CRC) at ABC Hospital) and explained the research topic, its purpose and the expected research contribution, and clarified potential participants who could contribute to the research with a minimum number of 15 participants from consultants, specialists, doctors, nurses and healthcare practitioners related to the preventive care.

Second, before the interviews were scheduled, the approval letter from MOH, Malaysia, the consent form, interview guides and completed interview questions were provided to the gatekeeper via email.

Third, several follow-up calls and emails to the gatekeeper confirmed the planned interview sessions. As a middle person, the gatekeeper suggested two relevant departments of ophthalmology and surgical, and three non-clinical departments, a dietetic unit, physiotherapy unit and health-education unit that were available for conducting the case study.

Fourth, I held a few meetings on the hospital site with the gatekeeper to clarify and complete the procedures at the hospital level. With approval from the head of the two clinical departments and three non-clinical departments, the participants were then selected based on a mixture of the snowballing technique and volunteers from those who had time from the departments approved. The snowballing technique was useful in this research as it involves locating other potential participants who exemplify the characteristics of interest in the research (Merriam 2009).

Fifth, after the procedures at the hospital level were met, I accessed the departments approved by the head of departments and the hospital director to conduct the interviews with the participants.

3.5.2 *Conducting the interviews*

The semi-structured interview format used in this research followed conversational mode, which allowed for some two-way interactions between me and the participants (Yin 2016). The questions used in semi-structured interviews are open-ended questions that encourage participants to converse in their own words while engaging in the topic being discussed. This research used the semi-structured interview as it enabled me to understand and appreciate participants' experiences. The time arranged for the interview session was approximately 30 to 60 minutes.

There were some challenges while conducting interviews with the healthcare practitioners. First, the nature of their work means they are always on the go, limiting their time for participation. Thus, I needed to provide a brief explanation of the reasons for conducting the interview. I also gave the interview guide and a plain language statement to the participants before the interview was conducted. The documents informed participants about the time required for an interview session. This was crucial as most participants considered their time as valuable, with the nature of the public hospital requiring them to attend to many patients. Thus, a participant might decline to participate if the time taken for the interview affected their central role of providing care to patients. A few potential participants declined to participate due to time constraints and department commitments, such as attending emergency cases. Additionally, there was one situation when I needed to wait from morning till evening at the hospital to interview one respondent due to her unpredictable schedule and commitment as a healthcare practitioner. Eventually, the interview turned out well, and she recommended one of her colleagues to be a potential participant. This experience taught me to be patient and never give up.

Second, there were many times when I had to reschedule interview sessions for the next available time that was convenient for the participant. This was due to shift work, which meant they could be working in the morning, evening and night. I was provided with an access card and an approval letter from the hospital director and MOH. So, despite the shift work hours, I was still able to access the wards, especially at night, to meet the healthcare practitioners. Although this was a challenging situation for a beginner researcher, it taught me perseverance and to always be prepared to deal with any situation.

Third, I faced the challenge of meeting with unexpected participants. For instance, I had a casual conversation with one of the healthcare practitioners on the topic of research. Later the person called me informing that his senior would like to participate and meet me a few minutes later. Thus, I needed to be flexible and always ready to meet with unexpected participants at random times. Furthermore, I had to prepare for the interview by equipping myself with a brief background of the person before the meeting. This was important because I had to meet with a different hierarchy of healthcare practitioners and had to convince the person of the importance of the research. Therefore, having some knowledge about the potential interviewee was crucial, providing a general idea of the person and ensuring I asked relevant and accurate interview questions according to their position.

The fourth challenge was understanding the medical terms. During the interviews, the participants mentioned some medical terms that were unfamiliar to me. Therefore, brief research was required, and questions asked to clarify meaning. Hence, I learned to persevere, be determined to meet different people at different levels and be prepared to face disappointment when the progress of the data collection on certain days was not met.

I covered two clinical departments for this research – surgical and ophthalmology and three non-clinical departments – a dietetic unit, physiotherapy unit and health-education unit. The interviews were normally conducted, either at the participant's ward or clinic. Before the interview began, I briefly explained the topic and the purpose of the research, and the interview guide was used to strengthen the interview. The interview guide included some keywords, a small subset of critical points and questions tailored to the topics for the interviews with relevant participants. The consent form was signed by the participants before the start of the interview. The interviews were conducted using both English and Malay as a medium of conversation. The semi-structured interviews consisted of open-ended questions designed to stimulate respondents to share their experiences, opinions and comments on the topic being studied – the IS competencies and IS capabilities for preventive care. I asked relevant questions based on the participant's position, but not necessarily in the same order as the prepared questions. Thus, the flexibility of the semi-structured interview enabled me to ask questions that went beyond the prepared questions to

gather more in-depth information and get a more in-depth understanding on the response given. The interviews conducted with the participants lasted between 30 and 60 minutes, as per the scheduled time arranged.

3.5.2.1 Case study protocol

I used the case study protocol outlined in Table 3.5 as a guide for the interviews, to emphasise case study procedures. According to Yin (2016), having a case study protocol is essential to increase the reliability of the case study research being conducted (refer to Section 3.7.4). A research protocol can help remind researchers of the original topic and questions. According to Yin (2016), a protocol covers broad procedures and queries and is not an instrument. Yin (2016) explains that the protocol is a mental framework that is in the researcher's head. In this research, the protocol covered the full range of topics related to the planned study to ensure I followed the systematic procedures thus, minimising errors and biases (Yin 2014).

Table 3.5: Case study protocol

Structure of case study protocol
<p>Section A: An overview of the case study</p> <p>Research topic: Developing a preventive care model: A healthcare information system case study</p> <p>Research question: How are hospital IS competencies and IS capabilities being used in HIS adoption to facilitate preventive care?</p> <ol style="list-style-type: none"> 1. How are resources being structured? 2. How are resources being bundled? 3. How are resources being leveraged? <p>The case study questions are formulated based on the HIS resource issues in preventive care and underpinning theories.</p>
<p>Section B: Data collection procedures and questions</p> <p>Selection of a case study</p> <ol style="list-style-type: none"> 1. A public hospital in a developing country 2. Contact person <p>Data collection plan</p> <ol style="list-style-type: none"> 1. Initial contact with the key person 2. Submit official letter and ethics application 3. Arrange the field visit and interview <p>Data collection technique</p> <ol style="list-style-type: none"> 1. Technique 1: Interview 2. Technique 2: Documentation 3. Technique 3: Archival records <p>Instrument for data collection technique</p> <ol style="list-style-type: none"> 1. Voice recorder 2. Camera <p>Additional documents and things to bring during an interview session</p> <ol style="list-style-type: none"> 1. Approval letter from the Ministry of Health 2. Approval letter from hospital director and head of departments 3. Participants Information Consent Form 4. Notebook and pen 5. Souvenirs as appreciation <p>Case study questions</p> <p>Theme 1: Preventive care</p> <p>Theme 2: Structuring tangible-IT, intangible-IT, human-IT</p> <p>Theme 3: Bundling</p> <p>Theme 4: Leveraging</p>
<p>Section C: Guide for the case study report</p> <p>Case background</p> <ol style="list-style-type: none"> 1. Structure of the case study based on three resource orchestration processes and CEM 2. The report should include a summary of the matrix-table for the analysis 3. Elaborate the lessons learned from the case research

Note: IS = information system; HIS = hospital information system; IT = information technology; CEM = chain of effect model

3.5.2.2 Recording and transcribing the interviews

I used two primary ways to record the interview data – audio recording and taking notes. The purpose of recording the interviews is to preserve the conversation for analysis (Merriam 2009). In addition, having the interviews recorded helped me to listen to the records and improve the questions and questioning technique.

The purpose of taking notes in an interview session is to add important points that have been said by participants in addition to the audio tape (Merriam 2009). Moreover, following the interviews, I immediately wrote reflections of the interviews, such as descriptive notes on the behaviour of participants.

The process after recording is followed by transcribing the recorded interviews. For this research, I decided to transcribe the recorded interview myself to become familiar with the data and terminology used by the participants, allowing for any correction of errors and to fill in any blanks. The format of the interview transcript was set up before the transcribing process took place. At the top of the page was the interview information, such as when, where and with whom the interview was conducted (Merriam 2009). Single spacing was used to write the codes and notes. The important lines were highlighted to enable ease of reading the codes. Also, a column on the right-hand side of the page was provided to add additional notes. Moreover, having the interview data for transcribing in this research was not enough, as I needed to ensure the quality of the data obtained. Detail about how to ensure the quality of the data obtained is discussed later in Section 3.7.

3.5.2.3 Pilot study

A pilot study was conducted prior to the actual data collection exercise. The purpose of conducting a pilot study for this research was to understand the fieldwork procedures, such as the requirements needed from the hospital to conduct a case study, the willingness of the healthcare practitioners to welcome the research conducted at the hospital, the data collection instruments and the preferred time for conducting the interviews. The research was implemented in October 2015, by gathering information from the staff in the training unit and the gatekeeper to clarify the procedures and the requirements needed.

3.5.2.4 The in-depth interview

The purpose of the in-depth semi-structured interview was to uncover the IS competencies and IS capabilities for preventive care and to find out the mechanism whereby these IS resources were being used – specifically how the resources are structured, bundled and leveraged for preventive care. The in-depth interview was held in two phases with 40 participants from the two clinical departments – surgical and ophthalmology and three non-clinical departments – a dietetic unit, physiotherapy unit and health-education unit resulting in a total of 60 interviews (refer Table 3.6). This research ended up with a total of 40 participants that represented everyone in these departments and was sufficient because this is the number when saturation or redundancy is reached (Merriam 2009). Moreover, the number of participants exceeded the minimum level number of 15 participants generally recommended by the SPS approach, thus avoiding criticism and biased reporting (Pan & Tan 2011).

The interviews were conducted in two-rounds with a total of 60 interviews. First-round interviews were conducted from 22 August 2016 until 4 November 2016. The number of interviews conducted was 42. A semi-structured interview was conducted using English and Malay. All interviews were audio recorded and later transcribed and coded manually. Second-round interviews were conducted from 16 February 2017 to 11 March 2017 for follow ups and triangulation, with 18 interviews as shown in Table 3.6. The follow-up interviews with the same participants served as multiple sources of evidence, thus increasing the validity of the data (refer to Section 3.7.1).

Table 3.6: Summary of the participants, their roles and the number of interviews conducted

Role	Number of participants	First-round interview		Second-round interview	
		Number of interviews	Number of follow-up interviews	Number of interviews	Number of follow-up interviews
Dietician	1	1	–	–	1
Physiotherapist	5	5	–		3
Pharmacist	4	4	1		1
Doctors:					
Consultant	3	1	–	2	–
Senior	4	3	-	1	-
Junior	5	5	-		1
Nurses:					
Sister	4	3	1	1	1
Senior	3	3	1	-	2
Junior	5	5	-	-	-
Counsellor – Diabetic clinic	1	1	2		2
Counsellor – Quit-smoking clinic	1	–	–	1	1
Head of IT Department	1	1	–	–	–
Head of Education Department	1	1	1	–	1
Gatekeeper	1	1	1	–	–
IT officer	1	1	–	–	–
Total	40	35	7	5	13
Total interviews			42		18

3.6 Data-analysis procedures and methods

Data analysis is a process of making sense out of data to find answers to the research questions (Merriam 2009). The data analysis is conducted together with the process of data collection (Pan & Tan 2011). In this research, I used data analysis to develop categories and themes to interpret the meaning of the data. The data analysis was an interactive framing cycle between eventual case data, theoretical lens and models (Pan & Tan 2011). This, in turn, provided the answers to the research question.

This research adopted a five-phase cycle from Yin (2016) to perform the data analysis. I used Yin's structured analysis phase because this phase helped me to continuously concentrate on the link between data collection and the research question (Pan & Tan

2011; Yazan 2015). Moreover, Yin suggests that there is a need for the case study researcher to plan for data-analysis steps as this element is 'one of the least developed aspects' in producing analytic result (Yin 2014, p. 133). The following are Yin's five analysis phases:

1. compile database
2. disassemble data
3. reassemble data
4. interpret data
5. conclude

Phase 1 started with data compilation and sorting. Compilation is defined as a technique to organise or arrange data and notes in a useful manner. The completed compilation is termed a database. In this research, several files were created in the database, consisting of interview data and other related information (see Figure 3.4). The purpose of the compiling phase is to become refamiliarised with, and review, the data and field notes, and re-read the transcripts and re-listen to the audio record.

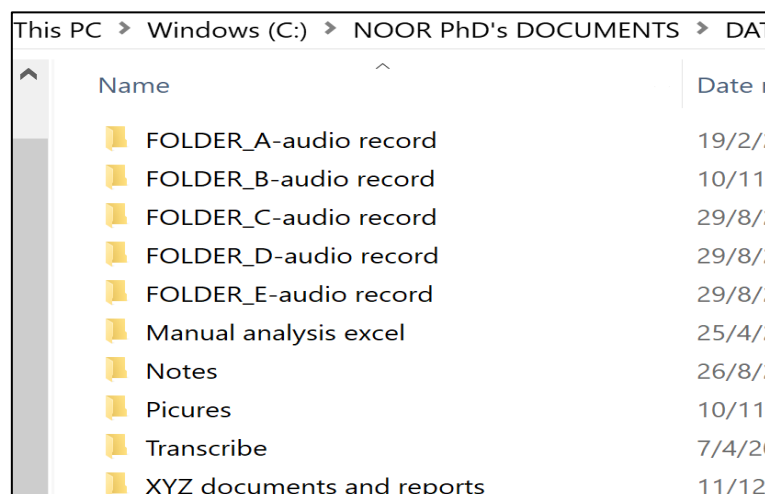


Figure 3.4: Example of folders for compiling database

Phase 2, disassembling data, involved dividing the compiled interview data into smaller pieces. During this phase, codes or labels were assigned to the pieces of data, and this process was repeated many times. The codes or labels were also refined several times. I utilised two levels of codes assigned to the data. Level 1 codes or open codes were formed from the participant's transcripts.

I used two types of Level 1 codes as a technique to assign codes that can be applied by a beginner researcher. They are in-vivo and holistic codes (Saldana 2013), which help to find Level 2 codes. In this research, the in-vivo code is referred to the key word that originally comes from the participant's responses. The following is a sample of how in-vivo code that is *peri team* was assigned to the interview data transcribed:

*Dr H #22: Okay, let say the patient is in the medical unit and suddenly the patient has bleeding from inside stomach, so we have to refer to the surgical department. We will talk to their medical officer, present the patient case and request for a special team to come and help us examine this patient in the medical unit. We call them **peri team**.*

There are also other types of coding used for analysing data, such as holistic coding. The holistic code is formed by choosing several lines or a paragraph from the participant's responses as a code. The following is an example of assigning a holistic code to the interview data:

Nurse Sf #17: We have great tasks and are very close to our patients. We are like middle person between the doctor and the patients. Patients are comfortable to tell us about their condition.

Level 2 codes are achieved when the coding proceeds to a higher set of codes that belong to the same group or categories that are called category codes (Merriam 2009; Yin 2016). For example, in this research, after several codes were assigned to the data, the assigned codes that belonged to similar groups were placed under a category. This phase can go back and forth while compiling the data in Phase 1. Figure 3.5 illustrates finding Level 2 codes from Level 1 codes.

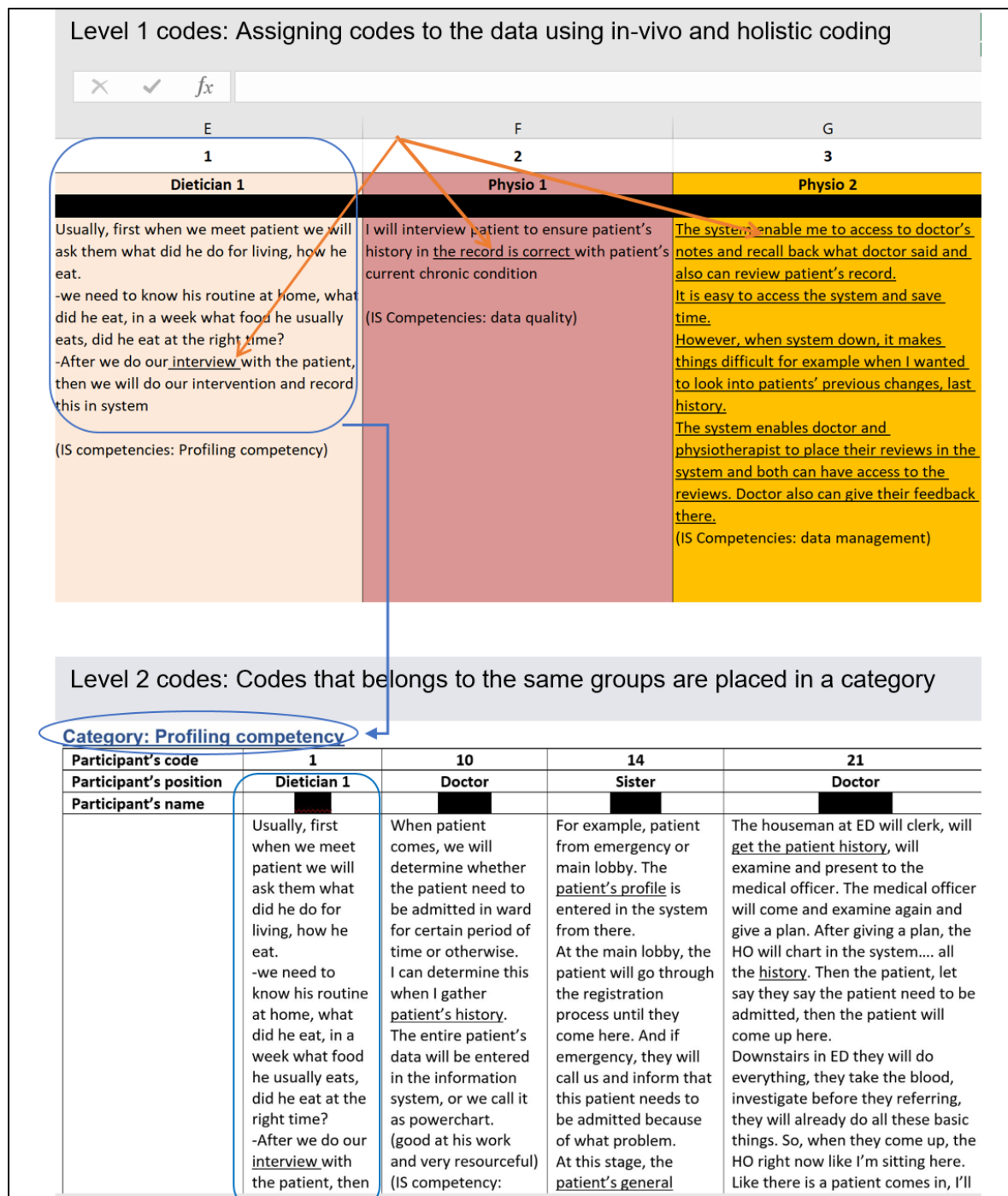


Figure 3.5: Example of assigning Level 1 codes to find Level 2 codes

Phase 3, reassembling data, involves finding patterns from the codes and categories. From a group of codes (Level 1 codes), a few categories (Level 2 codes) are developed, which are then given themes. Themes are a higher conceptual phase, also known as Level 3 and Level 4 codes. Thus, finding the themes for this research required reassembling or searching for patterns. The reassembling procedure included reorganising and recombining pieces of data into different groupings. The

data were rearranged and recombined graphically, or by grouping or displaying them in the form of lists and tables, such as tables to reassemble data (see Figure 3.6) to develop themes. This phase can be repeated several times in turn with disassembling data in Phase 2. The following is a sample of a table to reassemble data to find themes, showing an example for Theme 1.

Theme 1: Competency in patient medical information management

Category: Profiling competency

Participant's code	1	10	14	21
Participant's position	Dietician 1	Doctor	Sister	Doctor
Participant's name	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
	Usually, first when we meet patient we will ask them what did he do for living, how he eat. -we need to know his routine at home, what did he eat, in a week what food he usually eats, did he eat at the right time? -After we do our interview with the patient, then	When patient comes, we will determine whether the patient need to be admitted in ward for certain period of time or otherwise. I can determine this when I gather patient's history. The entire patient's data will be entered in the information system, or we call it as powerchart. (good at his work and very resourceful) (IS competency: patient's general	For example, patient from emergency or main lobby. The patient's profile is entered in the system from there. At the main lobby, the patient will go through the registration process until they come here. And if emergency, they will call us and inform that this patient needs to be admitted because of what problem. At this stage, the patient's general	The houseman at ED will clerk, will get the patient history, will examine and present to the medical officer. The medical officer will come and examine again and give a plan. After giving a plan, the HO will chart in the system.... all the history. Then the patient, let say they say the patient need to be admitted, then the patient will come up here. Downstairs in ED they will do everything, they take the blood, investigate before they referring, they will already do all these basic things. So, when they come up, the HO right now like I'm sitting here like there is a patient comes in...

Theme 1 is developed by searching for patterns from the categories

Category: Profiling competency is developed from the codes that belong to the same groups

Figure 3.6: Sample of table to reassemble data to find patterns for theme development

Phase 4, interpreting the reassembled data, is supported by lists and tables. In this phase, the database can be recompiled (Phase 1), disassembled (Phase 2) or reassembled (Phase 3). For this research, I used analytic techniques, such as explanation building and logic models (Yin 2012), and analytic display methods such as a matrix display (see Appendix 11) and a table of resource mapping (see Appendix 12) (Miles, Huberman & Saldana 2014) to facilitate an overall view of how resources, IS competencies and IS capabilities are developed for preventive care.

These techniques and methods are used as the tools to interpret and write up the research findings in Phase 5, which involves concluding the entire research.

3.7 Data validity and reliability

There are numerous ways to evaluate and enhance the rigour of overall qualitative research quality provided by methodologists (Creswell 2014; Merriam 2009; Yin 2014). This research followed Yin's (2014) specific tactics, systematically provided in each phase of the research, which helped me develop a rigorous and robust case. Yin (2014) suggests four tests to establish research validity and reliability – construct validity, internal validity, external validity and reliability. Table 3.7 presents the tactics used in this research for dealing with these four tests.

Table 3.7: Data validity and reliability (Yin 2014)

Test	Case study tactics	The phase of research in which tactics occurs
Construct validity	Use multiple sources of evidence	Data collection
	Establish a chain of evidence	Data collection
	Have a key informant to review draft case study report	Composition
Internal validity	Do explanation building	Data analysis
	Use logic models	Data analysis
External validity	Use theory in single case study	Research design
Reliability	Use case study protocols	Data collection
	Develop a case study database	Data collection

3.7.1 Construct validity

This research utilised three tactics for identifying correct operational measures for the concepts being studied to increase construct validity. First, I used multiple sources of relevant evidence during data collection. Second, I established a chain of evidence during data collection. Third, key informants reviewed the draft case study report.

In the first tactic, I used triangulation with multiple sources of evidence. The major strength of a case study data collection is the ability to use many different sources of evidence. Data triangulation helps to increase construct validity. This can be achieved by developing convergence evidence in which multiple sources of evidence are triangulated to test consistency. Triangulation of data facilitates validation of data through cross verification from more than two sources. It tests the consistency of findings obtained through different sources of evidence.

In addition, triangulation is important to achieve an accurate perspective from participants. This can be done by querying the same participant several times or on several occasions, thus serving as a set of multiple sources of evidence. The use of triangulation, in this case, is to confirm the findings and to have an explanation about the findings derived from the interviews to increase the confidence that the event studied is accurate.

The second tactic of maintaining a chain of evidence in the research helps a researcher increase the reliability of the information in a case study. This principle is followed to enable readers to trace the steps in either direction from initial research questions to conclusions. For example, interviews are documented in an orderly manner with the time and place. Moreover, in this research, I ensured the information was consistent with the procedures and case study protocol.

The third tactic is to have constructive feedback from the participants on the case study findings. I approached the participants to go through the case study findings to obtain feedback, thus confirming the concepts being studied.

3.7.2 *Internal validity*

This research used an analytic strategy for analysing data, seeking to establish a causal relationship and understand how certain conditions are believed to lead to other conditions. First, I used an explanation-building strategy to help analyse the data (Yin 2014). Explanation building occurs in narrative form, where a structured format is prepared to enable the researcher to write the explanations based on the categories. Moreover, I used theoretical orientation in the research guides for the case study analysis. For example, the concepts from the theory used helped me organise and explain the data. In addition, having a theoretical orientation helped achieve a more precise explanation of the data (Yin 2014). Therefore, in this thesis, the case analysis in Chapter 5 is written in a structured format guided by the constructs from the theory and perspective used.

The second analytic strategy used for analysing the case data is to use a logic model (Yin 2014). I used the logic model by matching the findings from the research to the predicted events as in a theory (refer to Appendix 10). For instance, the logic model

helped explain the events happening between IS resources and preventive care performance within the RBV theory and the resource orchestration perspective. Thus, using a logic model enabled this case study research to 'open' the 'black box' (Yin 2014, p. 156), which in this case answers the two sub-research questions:

1. What information system competencies and information system capabilities are utilised in preventive care?
2. How are information system competencies and information system capabilities developed in preventive care?

In addition, the logic model used in this research helped me understand how whole events occurred because it served as a straightforward graphic that summarised the complex events. For example, the logic model used in this research allowed me to explain the case study findings in a precise format by showing the data analysed in the boxes and explaining the arrows connecting the boxes that reflected real situations.

3.7.3 External validity

External validity is concerned with the problem of knowing whether a research finding is generalisable beyond the immediate research, regardless of the research method used. The research question posed in this research, which is a *how* question, can hinder the preference for seeking generalisability; however, the use of theory in this research can help to address external validity. The identification of theory used in this research became the main vehicle for generalising the findings from the case study.

In addition, the role of theory in case studies is crucial in defining the appropriate research design and data to be collected. This research used a theory to help generalise the lessons learned from the case study, called 'analytic generalisation' (Yin 2016, p. 240). Analytic generalisation can be achieved because a case study can provide the opportunity to shed empirical light on some theoretical concepts or principles that go beyond the setting for a specific case being studied. Yin (2014) explains that in doing case studies, analytical generalisation, rather than statistical generalisation, is the one to be achieved. This is because the case being studied is not a sampling unit and is too small in number to generalise its findings or represent

the broader population. Thus, in case study research, the theory behind the initial design of the case study, enhanced by the findings, will allow for generalising findings or lessons learned that might potentially apply to a variety of situations. In analytic generalisation, transferability involves posing research implications at a higher level than from specific conditions in the initial research. The purpose of having analytic generalisation is that it allows for the determination of ideas and concepts or any similarities between the research findings and the main research literature (Yin 2016).

3.7.4 Reliability

Reliability demonstrates that the operations of research, such as the data collection procedures, can be repeated with the same results (Yin 2014). In this research, the creation of a case study database increased the reliability of the case study (Baxter & Jack 2008; Yin 2014). This can be done by organising and documenting the data collected systematically. The purpose of having a database is to preserve the collected data in a retrievable form (Baxter & Jack 2008). The case study database created for this research contains many documents, for example, notes that resulted from the interviews, audio files, pictures or document analysis (refer to Figure 3.4 in Section 3.6). Other examples are documents downloaded from the organisation's websites or copied from the department database, tables and narratives.

The second aspect of reliability is to have a case study protocol to highlight the procedure taken while undertaking a case study approach. The case study protocol increases the reliability of the case. A protocol was used in this research to remind me about the original topic and questions (Yin 2016). A protocol is like a procedure and queries, not an instrument, because it covers a broad line of inquiries that serve as a mental framework. The advantages of having a protocol are to point to any opportunities for finding supporting evidence. It is also used to achieve convergence and triangulation of evidence. Finally, a protocol helps to find any possibilities of discovering new insights during the data collection process.

3.8 Conclusion

This chapter outlined the importance of having a rigorous methodology in conducting research. The research methodology employed in this research has led to the

exploration of IS competency and IS capability development in achieving preventive care. A case study was employed in this research (Eisenhardt 1989; Yin 2003) in order to understand the meaning and knowledge constructed from different types of people (Merriam 2009) participating in the research.

A single case study was chosen for this research to explore the unique case of ABC Hospital. A single case study provided me with a strategy to find an explanation rather than testing a single variable or factor (Yin 1981). Also, a single case study was appropriate for the aims of this research, to obtain an in-depth understanding of the context of the research by interacting with the practitioners, to allow for a detailed analysis, provide descriptions, and generate and test theory.

I employed an SPS approach in this research to conduct a case study as suggested by Pan and Tan (2011). The eight steps of the SPS approach was enhanced by the work of Yin (2016) for the data-analysis phase, Miles and Huberman (2014) for the tabular display and Saldana (2013) for the coding technique that helped me develop the themes.

The participants were selected based on a mixture of the snowballing technique and volunteer from the two clinical departments, and three non-clinical departments approved. I collected the research data using semi-structured interviews as well as utilising documents, archival records and field notes. These methods assisted me to perform the interviews and gather reliable information to the theoretical saturation point, resulting in a total of 40 participants with 60 interviews. The interviews were transcribed and coded by employing Saldana (2013) in-vivo and holistic coding techniques. Five data-analysis phases (Yin 2016) were employed to analyse the research data and search for themes. Both coding and analysis processes added to the existing SPS approach used in this research.

Chapter 4 describes the case study of a public hospital, ABC Hospital. I used a pseudonym to maintain as much confidentiality as possible. Chapter 4 describes the background of ABC Hospital, its resources, awareness of preventive care, preventive care patient processes and the special services it provides to chronic disease patients.

CHAPTER 4 – ABC HOSPITAL: A CASE STUDY

This chapter describes ABC Hospital, highlighting the unique characteristics that made it the ideal organisation to select as the case study for this research. The hospital requested its identity remain anonymous; therefore, the hospital is referred as ABC and the identities of staff will be kept hidden for privacy. This chapter outlines the hospital's background and resources, and its preventive care awareness programs, services and patient care processes.

4.1 ABC Hospital: Background

ABC Hospital became an example to other hospitals in Malaysia when it succeeded in the use of IT in all operational aspects (Hannah & Ball 2004). The objective to improve hospital operations through IT was achieved with assistance of a multimillion-dollar IT investment by the government in building the hospital and implementing innovative healthcare technologies (Mohamad Azrin 2004).

After going through many challenges prior to project completion, ABC became a renowned healthcare provider in its region, designed and equipped with a state-of-the-art HIS. The project to develop HIS started in 1996 and was completed in 1999, costing US\$16 million. With the implementation of HIS in 1999, ABC Hospital became the first paperless hospital in the country (Ismail et al. 2010).

This public hospital, pictured in Figure 4.1, is responsible for secondary and tertiary care that provides services for patients seeking general treatment as well as those referred from other government hospitals and private health organisations.



Figure 4.1: ABC Hospital

ABC has the highest number of patients in its district, with an average of 1,500 outpatients per day and around 170 inpatient admissions per day. These rates have been consistent since the HIS project was completed. The patient population consists of three major ethnic categories – Malay, Chinese and Indian – ranging from middle to lower income groups. It employs about 3,000 employees, comprising 1,000 management and professional staff, 1,600 paramedics and auxiliary staff and 400 supporting staff. The hospital operates in a fully integrated paperless and filmless environment.

ABC currently has among the highest number of specialist services offering secondary and selected national tertiary care services in Malaysia. With its large number of professional medical and nursing staff, together with better-quality medical equipment and a large number of beds, ABC is classified as a major specialist hospital that can provide up to 20 identified resident specialty and sub-specialty services (Jaafar et al. 2013). Among the specialty services provided are general medicine, general surgery, orthopaedics, obstetrics and gynaecology, radiology, ophthalmology, otorhinolaryngology, emergency medicine, psychiatry, and dental paediatrics. Its sub-specialty services are dermatology, hepatobiliary, infectious diseases, respiratory medicine, maternal foetal and neonatology (Jaafar et al. 2013).

ABC's successful implementation of innovative healthcare technologies and its capacity to offer several specialty services, provided a strong platform for the case study undertaken for this research.

4.2 ABC Hospital: Resources

The financial resources invested in ABC Hospital enabled it to develop IS competencies and capabilities that facilitate preventive care, thus increasing its capacity for health promotion and preventive care in addition to treating sick people (Kaur 2013). Its development of preventive care services relied on an integrated IT portfolio comprising tangible, human and intangible resources.

4.2.1 *Tangible information technology resources*

HIS and its related technology infrastructure (hardware and software) make up the hospital's tangible-IT resources. To ensure continuity of the hospital's daily functions, it has a fully integrated HIS, pictured in Figure 4.2, covering administrative, clinical and financial elements, with a focus on better patient care.



Figure 4.2: Integrated hospital information system in ABC Hospital

Note: Identities of staff have been hidden

In this well-integrated system, computers are used in each clinical department, in the wards and in the hospital library to facilitate the quality of preventive care delivered by healthcare practitioners. Proper application of HIS by healthcare practitioners enables them to perform their tasks at any point of care. Doctor notes and plans, nurse charting, pharmacist monitoring reports, radiology reports, requests for laboratory investigations and ordering patient diets are all undertaken using HIS.

The following extracts from interviews with healthcare practitioners provide examples of how HIS is used.

A diabetic consultant, referring to doctor notes and plans, stated:

Dr F #27: The advantage is you don't have to spend so much time thinking of where you placed your notes on a patient's history, this is less labour intensive. You don't have to manually retrieve the paper medical files because everything is inside. And the record is not supposed to disappear, so you can easily track everything, it is all in there.

Nurses use charting to follow progress.

Nurse Sf #17: By using the system, we are able to know whether patient is following the preventive care treatment or not because we chart all patients' progress in the system.

Pharmacists use monitoring reports to ensure appropriate action in the case of unexpected effects of medication:

Pharma D #25: We have to monitor the effect of medication on patients from the patient's blood test result because in some patients' chronic disease cases, the medication can immediately cause acute kidney injury. If this is the case, we need to quickly stop the medication. We use the system to report this event in the system for immediate action.

However, tangible-IT resources must be used in combination with other IT resources (human and intangible) to be fully realised (Bharadwaj 2000).

4.2.2 Human information technology resources

Human-IT resources, including a sufficient number of healthcare practitioners with relevant skills, knowledge, good behavioural characteristics (Peppard & Ward 2004) and experiences (Ashurst, Doherty & Peppard 2008) to enable them to use HIS, ensure consistent high-quality preventive care at the hospital. During orientation week, staff (pictured in Figure 4.3) thus attend rigorous short courses run by the IT Department (ITD).

Medical staff who have undertaken the training explained:

Dr T #11: Initially, we don't know where to click the button or the functions. But then we go to class, we join ITD and have orientation.

Even medical officers from other hospitals who join this hospital need to go for ITD orientation as a requirement.

Physio F #5: I learnt a lot from others. To gain new experiences, knowledge and special massage techniques, I did attachment at another hospital. I did this to obtain advanced knowledge and skills in lymphedema training and to become certified in lymphedema management thus help to prevent this condition.



Figure 4.3: Information technology short course

4.2.3 Intangible information technology resources

ABC Hospital also places importance on intangible-IT resources, that is, the knowledge assets, synergy and customer orientation (Bharadwaj 2000) that reside in its doctors, nurses, specialists and clinical support staff, in order to develop its IS competencies and capabilities for preventive care.

Figure 4.4 is a picture of a specialist carrying out a preventive care service while referring to HIS (identities have been hidden). According to the consultant:

Dr S #37: I have a few colleagues [doctors], who are now furthering their sub-specialisation in the liver-related disease area. They are ABC's future important people because when they come back as experts, they will be able to share knowledge and teach others. Their expert knowledge, skills and experiences obtained from other institutions are valuable for making important decisions, especially for chronic diseases patients' care.



Figure 4.4: A team of specialists providing preventive care treatment to a patient using the hospital information system

Note: Identities have been hidden

Chapter 5 provides a detailed explanation with examples of how preventive care IS competencies and capabilities are developed from tangible, human and intangible-IT resources.

4.3 Preventive care awareness programs

Generally, preventive care is divided into three categories: primary, secondary and tertiary prevention (Kenkel 2000). Primary prevention reduces the occurrence of the disease, secondary prevention reduces its health consequences and tertiary prevention reduces disabilities associated with chronic illnesses (Kenkel 2000). As a national hospital with advanced medical care, specialists and HIS, ABC's preventive care mainly focuses on secondary and tertiary prevention. Primary prevention is mostly provided at district public health clinics (Jaafar et al. 2013; Liyanatul Najwa et al. 2016).

ABC promotes awareness of preventive care by its use of banners and posters showing the major risk factors for chronic diseases on the walls of the entrances to the clinics and wards. In addition, permanent drawings related to chronic diseases are displayed on the walls and along the main elevators, as pictured in Figure 4.5. Banners and posters are also placed on the way to the hospital café, where they can be seen by patients and the public, as pictured in Figure 4.6. Further, advertisements promoting a healthy diet are shown on TV screens located at strategic locations such

as at the central patient waiting area in the clinics, at cafés and in front of diabetes and quit-smoking clinics. They disseminate general information about daily calorie requirements to patients and the public. Facebook is also utilised to show correct techniques for medical devices that control chronic disease complications, as pictured in Figure 4.7. This effort to promote an attractive environment showing sound preventive care information helps patients and the public see the importance of preventive care.

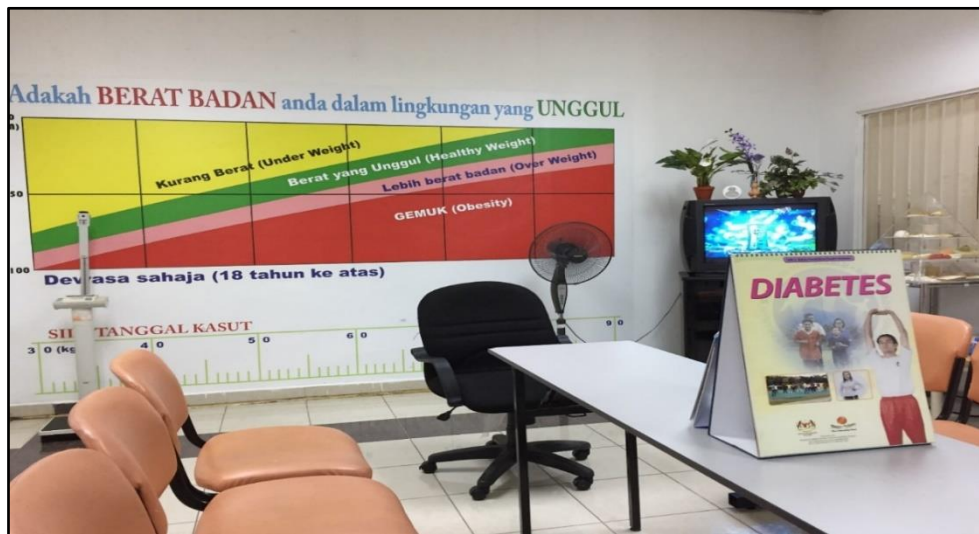


Figure 4.5: Permanent drawings on the wall



Figure 4.6: Posters on risks of chronic diseases



Figure 4.7: Videos on appropriate techniques for using medical devices

ABC is actively involved in organising awareness campaigns and forums on preventive care in conjunction with celebrating local and global events. For example, ABC annually organises campaigns and forums to support cancer survivors, awareness programs for obesity and diabetes, and celebrates nutritional month, as shown in Figure 4.8. Departments across the hospital, such as the General Surgical Department, Hepatology Department, Dietetic and Food Services Department and Pharmacy Department, collaborate with the MOH and other external agencies. The purpose of these campaigns and forums is to raise awareness about chronic diseases and to educate people on their risks and implications.



Figure 4.8: Awareness forum for cancers and nutritional month campaign

4.4 Preventive care services

In 2016, the proportion of all deaths attributable to chronic diseases in Malaysia was 76% (Institute for Health Metrics and Evaluation 2018). Most preventive care hospitals only provide primary and secondary care with basic care facilities (Aung et al. 2013; Boo et al. 2016). However, as a national referral centre, ABC provides an extensive range of secondary and tertiary preventive care services to the nation. To do this, the hospital established specialty services for secondary and tertiary preventive care in every unit to adequately address the growing threat from chronic diseases. It was thus able to reduce patient waiting time and, more importantly, provide higher quality patient care by offering specific treatments according to its specialty services and care facilities. Challenged by the increasing burden posed by communicable and chronic diseases, ABC made preventive care part of the acute care domain, linking it to each of the major services, and provided in parallel with acute care. Its preventive care component completes a healthcare system that includes all essential aspects of healthcare delivery (Hirshon et al. 2013).

ABC provides preventive care services to patients who require medical treatment and care from a specialist. The preventive care services include secondary and tertiary prevention and supported by primary prevention service to patients. The services are delivered explicitly to people with multiple chronic diseases such as diabetes type 2, cardiovascular disease, hypertension and cancer who are at high risk of getting worse and who may be referred for hospital readmission. Such situations arise when patients seek treatment after being identified as having a chronic disease, or seek treatment when they already have late-stage complications (Farooqui et al. 2011; Leong et al. 2007). Preventive care is grouped into three categories (Kenkel 2000). Primary prevention focuses on reducing the occurrence of a disease which is before the diagnosis, secondary prevention focuses on reducing or eliminating health consequences of disease, and tertiary prevention refers to reduce disability associated with a chronic illness which is emphasised during and after the diagnosis (Kenkel 2000).

Typically, patients who seek treatment at ABC are elderly. Most have at least two major co-morbid chronic illnesses, such as coronary heart disease, chronic obstructive pulmonary disease, chronic kidney disease or diabetes. ABC receives most referrals

for eligible patients directly from other district hospitals, health clinics and private medical centres.

Since ABC opened its services to the public, its preventive care service, especially in providing specialised care to chronic disease patients for secondary and tertiary preventive care has been highly successful. For instance, as a renowned national tertiary referral centre for one of the cancers, ABC receives about 150 patients with the cancer every year with an overall survival rate of more than 70%. Moreover, with its many specialties, ABC is a training hospital for one of the public universities in Malaysia, providing teaching facilities for a particular chronic disease aspect for Year 4 and 5 medical students. The university established a chronic disease unit at ABC, and has received full accreditation to become a training centre. A clinic for that chronic disease is also held at ABC Hospital on selected days.

Dr Z #19: ABC has many sub-specialities that most of the other hospitals do not have. For an example of sub-speciality, our ophthalmology unit has a diabetic retinopathy area. Other departments also have their own sub-specialities. To this date, we are proud to say that ABC is receiving many medical students; nursing students and even doctors are coming here for practical or furthering their studies and sub-specialities, and the reason is because of the experts and the sub-specialities that ABC has.

Other than becoming a training hospital, ABC also plays an important role as a referral centre to another district hospital (known as a sister hospital) nearby. ABC's specialist and medical officer visit the sister hospital to share their specialty skills and knowledge, offering consultation and treatment to the sister hospital's patients. ABC also provides training to the healthcare practitioners at the district hospitals. Thus, ABC's specialty services play a crucial role in providing preventive care services and training, sharing expertise and treating patients for specific medical needs on chronic disease categories such as diabetes, heart disease, cancer and respiratory problems.

To ensure its preventive care is successful, ABC focuses on three components – administrative efficiency, quality of care and health promotion. First, administrative efficiency is evidenced by the way ABC healthcare practitioners manage how the services are delivered to patients (Krist et al. 2013). For example, a patient suffering from chronic diseases is admitted to the ward, scheduled for blood tests and scans,

and prepared for counselling. A patient report is prepared, treatment is organised, and medication prepared and administered. As Nurse K explained:

Nurse K #38: Patients with smoking habits usually have cardiovascular problems. I have received many cases like this. When a patient is referred to this unit, the first thing is to organise the treatment procedures that the patient will need to go through. By doing this, the patient will understand the reason for getting the treatment. For example, I will explain that the patient will need to go through carbon monoxide test to determine their smoking status and what the level means. This is because if the patient knows his carbon monoxide level, the patient may be prone to quit smoking. And if the patient is a light smoker, it is more likely that he may want to stop straight away.

Second, quality of care refers to “whether individuals can access the health structures and processes of care, which they need and whether the care received is effective” (Campbell, Roland & Buetow 2000, p. 1614). At ABC, a structured patient care process is provided and the patient will go through several appropriate care scenarios in each process to ensure they receive the best care from healthcare practitioners. For example, a patient will be advised on treatment plans and alternatives, treated by a health professional team, taken care of and monitored closely by trained nurses, and will receive education and counselling from the dietician and pharmacist. In certain cases, they will also receive guidance and support from a physiotherapist to improve the physical aspects of their condition. The following is one example of how the consultant explains the doctors’ efforts towards patients that may lead to quality of care:

Dr St #39: A doctor is a role model to another practitioners. As a doctor, it is how you treat, communicate and educate a patient until you can clear the patient’s doubt on their health issues. I always stress to my doctors how they should deliver news on the patient’s disease, advise the patient on the treatment alternatives and the implications from the treatment. I can see that if my patient can understand clearly what is happening to them, they will be open to accept the doctor’s suggestion on the treatment plans and finally follow all the treatment suggested.

Third, health promotion in ABC includes holding awareness campaigns for the public, conducting patient education and counselling to raise awareness, providing education on chronic disease risks, and providing care management. Gullotta and Bloom (2003) refer to health promotion as a range of activities with the purpose of improving the health of individuals, groups and communities through general activities like health

education, health communication and social activities. Section 4.3 discussed some of these examples, and Section 4.6 highlights more examples.

4.5 Preventive care patient processes

To achieve the above-mentioned three main components of preventive care (administrative efficiency, quality of care and health promotion), ABC integrates its tangible, human and intangible-IT resources within its preventive care patient processes. This combination of IS resources helps to develop the IS competencies of the healthcare practitioners. These competencies consist of relevant skills sets and IS capabilities that are used during patient care processes to deliver preventive care. These crucial elements are portrayed by the healthcare practitioners and applied during the day-to-day operations and procedures in preventive care patient processes. The healthcare practitioners involved during the preventive care patient processes are from many disciplines, including doctors, nurses, dieticians, pharmacists, physiotherapists and health-education officers. Figure 4.9 depicts ABC's six preventive care patient processes.

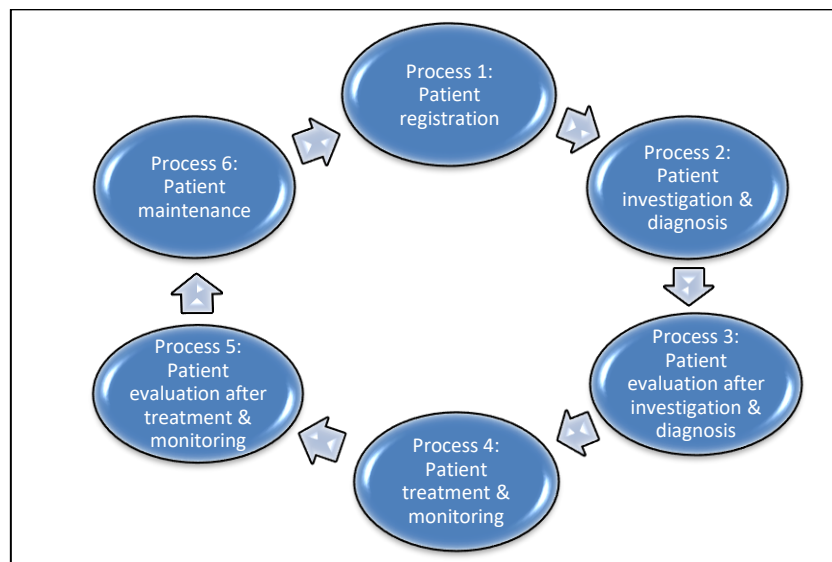


Figure 4.9: Preventive care patient processes at ABC Hospital

4.5.1 *Process 1: Patient registration*

The registration process starts with enrolling the patient by entering their general information into HIS. Next, the registration nurse identifies the patient's referral case to the appropriate department. A nurse then assists the patient to the department's

clinic for assessment. A nurse trained in multi-specialty care then examines the patient. In the first part of the clinic visit (which lasts for approximately 30 minutes), a comprehensive assessment of the patient's medical and psycho-social needs is completed. The nurse records vital signs and any issues while discussing the patient's home environment and possible need for support. For example, in a diabetes referral case, Nurse In explained how she gathers a patient's data for profiling:

Nurse In #12: The first thing before further procedures are done, we interview our patient to understand their background. We would like to know their daily food intake, where they get their food, is it home cooking or outside food. If the person is working, then they probably will eat at their workplace. From what we discover, we will compare the patient's data with the ideal food intake and record this information in the system.

Next, a patient that has a severe condition is prepared for admission to the ward as an inpatient to receive preventive care treatment, while in less severe cases, the patient is scheduled for an outpatient clinic consultation (usually to occur within one to two weeks depending on severity) and is provided with appropriate medication.

4.5.2 Process 2: Patient investigation and diagnosis

After the registration process, the patient is assisted to the relevant clinic for investigation and diagnosis by a doctor. The patient's health condition is evaluated, and the patient is provided with an explanation about their health situation. One of the doctors explained this process for a patient suffering from colorectal cancer:

Dr M #21: The treatment plan will depend on patient condition. The explanation provided is based on the investigation results, the diagnosis and all the examination reports for that patient. Sometimes, if the tumour is at low level of our body, near the anus, another operation is needed. If the tumour is at the lowest level, then the operation is called abdominoperineal resection [surgery for rectal or anal cancer] is required. Sometimes when the tumour is big, we need to do a pelvic exenteration [the urinary bladder, urethra, rectum, and anus are removed]

During this time, if the patient is suffering from a severe chronic disease, they are prepared for admission to the ward. The nurse at the clinic advises the relevant ward of the coming admission. This is important, as it informs nurses at the ward to be alert to the patient's condition, prepare their bed and make sure the facilities needed are

available. ABC usually receives patients with late-stage conditions suffering from severe complications caused by chronic diseases who need to be admitted to the wards. According to a nurse from the ophthalmology department:

Nurse Ms #15: Most patients come in with the advanced stage of their disease. For a patient diagnosed with diabetic retinopathy or diabetes in the eye, they don't come early, because why? From my experience, if a patient has diabetes for one or two years usually they didn't notice their diabetes is getting worse until they are having difficulties seeing clearly. Until patients feel that they don't have clear vision, only then they will seek treatment.

This is because most chronic diseases are known as 'silent killers' with the signs or symptoms not appearing in the early stage of the disease. Thus, patients might not be aware that they have established a chronic disease until it shows complications. Therefore, investigation and diagnosis for preventive care are important to determine the stage of the disease.

4.5.3 Process 3: Patient evaluation after investigation and diagnosis

Following diagnosis, a patient with a chronic disease is provided with preventive care treatment alternatives according to the severity of the disease. The doctors and specialists are responsible for planning comprehensive treatment procedures for the patient. Moreover, the specialist may explain the importance of the preventive care treatment available and its impact. Based on the preventive care treatment alternatives provided, the patient may have to choose the preferred treatment, with assistance from the healthcare practitioners who provide answers to any questions the patient may have. Dr T explained:

Dr T #11: My patient, he just knew he had cancer. Depending on how patient is doing, we can plan for ostomy surgery. We can create a stoma with this pouch outside, so that intestinal contents will pass through the stoma. In certain cases, if the patient does not want any intervention, depending on the patient's health condition at that time, we will tell them to do chemotherapy, and if he still cannot accept it, we will refer them to the palliative unit to manage the final stage of patient's life.

4.5.4 Process 4: Patient treatment and monitoring

During this process, the healthcare practitioners provide comprehensive preventive care treatment and care according to patient's health conditions, and monitor the patient's progress from time to time. For example, at the ward, a patient suffering from a chronic disease will be treated and monitored closely by a team of doctors, nurses and clinical support staff.

Dr Mh #10: In the surgical ward, we have a team consisting of senior and junior doctors, and specialists, and certain cases will be referred to the consultant for advice. We also need a dietician and a physiotherapist for diet counselling and exercises.

To achieve quality of care, a specialist doctor will lead a specialised team. This team is responsible for executing the plan, evaluating and monitoring patient progress, and referring the patient to relevant special clinics and health-education classes. This process improves the overall patient experience, as explained by the dietician:

Dietician: I have one case, where this patient has multiple chronic diseases. He is obese and he is suffering from a stroke. This is quite a challenge for me and my colleague to help him improve his health. As one of the team members, I plan for the patient's diet management; that is important to help him reduce his weight. Next, we must ensure the patient can achieve a certain weight so that he can perform relevant exercises to strengthen his muscles during physiotherapy sessions. We always motivate our patient and want him to understand the objectives of the treatment so that at least he can achieve some of the treatment goals. With the right treatment offered, I am happy to say that some of my patients could move their limbs and even start to walk.

4.5.5 Process 5: Patient evaluation after treatment and monitoring

During this process, the healthcare practitioners continue to evaluate the patient's health progress from time to time to ensure that the patient is doing well with the preventive care treatment delivered in the ward. Moreover, healthcare practitioners may identify patients at the ward who are not following the medication and other preventive care treatment instructions, such as diet, and recommend they participate in further counselling sessions. This process thus assists the patient to revise their technique for medication consumption, diet intake and exercise method, and to understand the purpose of the preventive care treatment. Following the right

instructions and understanding the purpose of having the preventive care treatment may in turn reduce the risk of recurrence of the disease.

The dietician on a diabetes case provided an example. The dietician conducted a diet intake review to ensure they were following the diet plan, and thus helped the patient balance their nutrient intake, which may reduce the impact of the chronic illness.

Dietician: From my observation, I know the patient does not take much food because of their illness and the treatment. Therefore, I must encourage the patient to eat first to recover before I continue with any counselling session. When the patient's appetite has improved, then I will start talking and counselling them about diabetes and how to eat right to control the disease from getting worse. For example, the patient still can enjoy eating foods that they love but in a different version. I will provide a diabetic product, such as if the patient loves to drink milo, I will introduce them to a chocolate beverage that is specially formulated for diabetic patients. I also will advise the patient and the family members on how to manage their food intake. Support from family members will help the patient to be disciplined to follow the right diet.

4.5.6 Process 6: Patient maintenance

As part of the preventive care patients are discharged from the hospital if they are deemed stable, improved, do not require ongoing review, or can have a follow-up from the nearest health clinic or district hospital. In addition, the dietician, pharmacist and physiotherapist will review the patient's plan with the patient and any caregiver, provide relevant information and plans about eating correctly at home, correct medication intake and step-by-step exercises that can be applied at home.

Physio W #2: If a patient stops doing exercises, it will slow their recovery. That is why physical exercises are important to help patients improve their condition. We understand that at home, the patient may not have the same hospital exercise equipment. Therefore, we teach the family members or the carers to modify suitable things at home into functional exercise equipment. This will encourage the patient to continue doing exercises when they are at home, thus helping to reduce muscle stiffness.

Also at this stage, all the patient's data gathered from the clinical procedures are recorded and stored systematically in HIS for further evaluation and future reference by the healthcare team in ABC and in other hospitals.

4.6 Special preventive care services

In addition, to the above six processes, ABC Hospital also provides special preventive care services through three units – the diabetes clinic, quit-smoking clinic and health-education class. The diabetes and quit-smoking clinics, pictured in Figure 4.10, were established to assist with health promotion through education and counselling. The clinics are run by experienced senior nurses and are supervised by senior doctors and consultants. These services are provided on a referral basis, whereby doctors can refer patients from any inpatient department for further advice and continuous health improvement during their treatment and before discharge.



Figure 4.10: Diabetes and quit-smoking clinics at ABC Hospital

For instance, a patient who has been diagnosed as having early diabetes will be referred by a doctor to the diabetes clinic to gain further understanding and awareness about diabetes. At this clinic, a diabetes educator will provide information about diabetes, show the correct way to use devices and monitor the patient's progress. In addition, the educator may attend the outpatient's ward to provide patients with advanced stage diabetes and severe complications with education and counselling. These services are usually offered during the patient treatment and monitoring process, and during the evaluation process. The educators always encourage family members to be involved with the patient during any follow-up. The educators also welcome any enquiries from patients and family members about the disease.

Nurse In #12: Serious wounds may cause infection and result in leg amputation. Therefore, before the patient's condition gets worse, we will educate and counsel the patient on how to control their sugar level so that their blood circulation is right and help fasten the healing process. We also show them how to clean and treat the wound properly to avoid infection and to ensure another foot is not affected. During the counselling, we emphasise the importance of foot care and explain the implications, such as bacterial infection can enter the blood vessel and can attack organs such as the heart and kidneys and cause organ failure like kidney dysfunction.

At the quit-smoking clinic, patients are provided with education and counselling to help them practice positive steps in quitting smoking. Patients are also scheduled for follow-up and are supplied with medication to reduce their smoking. Patients who visit this clinic include those who are addicted smokers, with some having chronic diseases such as cancer, cardiovascular disease and respiratory disease.

The health-education unit is responsible for conducting classes, as pictured in Figure 4.11, as well as organising events and activities to provide knowledge for inpatients, outpatients and the public. Classes are arranged according to the type of chronic disease, and may include for example, hypertension, diabetes and respiratory disease, and cover a range of important topics such as foot-care management, symptoms of the disease, medication advice, as well as offering an opportunity to patients and the public to discuss related health issues.



Figure 4.11: Patient health-education class for hypertension at ABC Hospital

Patients are provided with relevant documents and an education kit during the class. The class is free, and includes a snack at the end of the session. The health-education class schedule is posted on the hospital website, can be obtained in the form of pamphlets from the health-education unit, is placed at the diabetes clinic and mounted as banners at the entrance in the main lobby. During the class, a team of multidisciplinary healthcare practitioners deliver a talk, educate patients and the public regarding the risk factors of the disease under discussion and provide knowledge about prevention. Furthermore, this unit creates advertisements and collaborates with clinical departments to organise campaigns for preventive care.

4.7 Conclusion

ABC Hospital's unique characteristics make it an interesting and important case to research, and demonstrate how a health organisation can develop and utilise its IS competencies and capabilities through its IS resources, in an overall preventive care patient process, and thus influence preventive care performance. ABC's unique characteristics are:

1. It has a strong IT infrastructure that enables it to provide effective preventive care.
2. The large size of this hospital enables it to receive a high number of chronic disease patients who require preventive care services.
3. This hospital has successfully initiated many preventive care processes, helping it to promote preventive care.
4. Unlike many other hospitals, this hospital has an extensive range of secondary and tertiary services, including specialty services for preventive care, established in every unit of its services. These specialty services mean that patients with chronic diseases receive specific treatment according to the type of disease.
5. This hospital's preventive care patient processes enable its healthcare practitioners to deliver comprehensive care to patients.

In summary, these characteristics make ABC different from most other hospitals, providing a rich environment in which to research preventive care.

Some of the elements discussed in this chapter, such as the six preventive care patient processes in Section 4.5, were used as a foundation to construct part of the research framework, presented next in Chapter 5.

Chapter 5 is concerned with the findings of how IS competencies and capabilities were developed from IS competency bundling and capability bundling, and leveraged towards preventive care performance, thus answering the research question.

CHAPTER 5 – ABC HOSPITAL: A CASE ANALYSIS

The case analysis consists of two parts. First, Section 5.1 explains how the research framework in Chapter 2 was operationalised by analysing ABC Hospital (refer to Figure 5.1), followed by Sections 5.2–5.7 that provide a detailed explanation of how the IS capabilities at ABC Hospital were developed from IS competency and capability bundling, and then leveraged to achieve preventive care performance. Section 5.8 concludes this chapter.

In regards to trust and IS security about the users and patients' information in ABC Hospital, access to the system is subject to the role of the user which is limited based on their job scope. Generally, it is not the Malaysian culture to question or challenge the doctors or medical expertise about their privacy or rights. Moreover, patients have also signed a consent form to allow healthcare practitioners' to obtain and share their information for treatment purposes.

5.1 Research framework for information system competency and capability development in preventive care

Figure 5.1 presents the research framework for IS competency and capability development for hospital preventive care performance. Based on Figure 5.1, the answers to the sub-research questions are organised into two main dimensions. The first dimension consists of six preventive care patient processes – Process 1: patient registration; Process 2: patient investigation and diagnosis; Process 3: patient evaluation after investigation and diagnosis; Process 4: patient treatment and monitoring; Process 5: patient evaluation after treatment and monitoring; and Process 6: patient maintenance – as detailed in Chapter 4.

The second dimension is a spatial perspective that considers the IS capability development process for preventive care performance. Further, within each preventive care patient process, this study seeks to answer the central research question by addressing each of the sub-research questions, which are detailed in Sections 5.2–5.7. As shown in Figure 5.1, the case analysis reveals that each preventive care patient process was marked by the presence of IS resources, IS competencies and IS capabilities. The IS capabilities were essential for preventive care in ABC Hospital

because each IS capability includes a bundle of IS competencies underpinned by a combination of IS resources that enable the hospital to accomplish specific goals in achieving preventive care performance.

The case analysis found that the development of IS capabilities in preventive care patient processes can be achieved through two types of resource bundling cycles, rather than the one cycle proposed by resource orchestration (Sirmon et al. 2011). The two bundling cycles found in this study are IS competency bundling and IS capability bundling. IS competency bundling involves accumulating and stabilising IS resources to develop IS competencies. The analysis reveals that IS competency bundling results in six IS competencies, which are described in Table 5.1. The analysis reveals that IS competencies can be classified according to major and minor impacts on three elements: patients, hospital employees, and IT. IS competency plays a major impact when it is critical to patients, hospital employees and IT within the hospital. However, IS competency plays a minor impact when it influences those same elements. IS capability bundling involves enriching a combination of IS competencies. The analysis reveals that IS capability bundling results in four IS capabilities, which are described in Table 5.2.

To understand the processes of IS competency and capability development in preventive care, I undertook an iterative process between the relevant literature, the qualitative data and the emerging model. Sections 5.2–5.7 explain the process model in detail, and show how each of the IS capabilities is developed from the two types of bundling cycles, thus providing answers to the sub-research questions (see Figure 5.1).

Sections 5.2–5.7 are organised by each preventive care patient process, starting with leveraging IS capabilities for preventive care performance, followed by forming IS capabilities from IS capability bundling and creating IS competencies through IS competency bundling, with each section accompanied by a figure that summarises the findings. These sections are structured to assist readers to capture IS competency and capability development processes in their entirety from the view of every preventive care patient process. This structure may enable readers to appreciate the complexity of resource development processes from the two types of resource bundling in facilitating preventive care performance in ABC Hospital.

Along the way, readers will notice that there are overlapping IS competencies found in the six preventive care patient processes. This indicates that one IS competency may be used for different purposes, and may vary when applied in different preventive care patient processes.

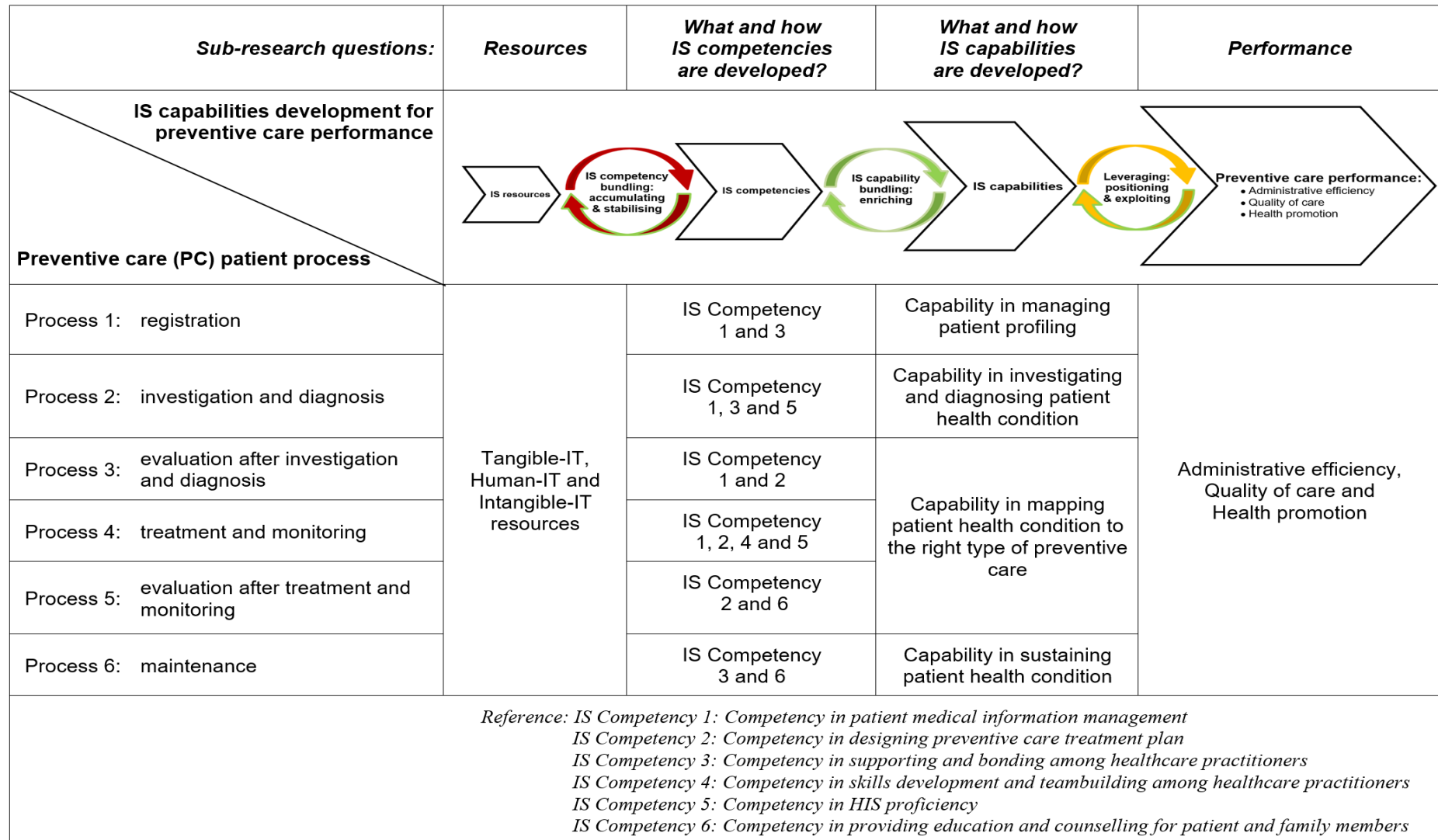


Figure 5.1: Research framework of information system competency and capability development for hospital preventive care performance

Table 5.1: Summary of information system competencies

Aspects of information system competencies	Classification of information system competencies		
	For patients	Among hospital employees	Within IT
Competency in patient medical information management: The skills to prepare patient profiles, manage patient data, analyse patient data, ensure quality, privacy and confidentiality, and patient safety. This involves gathering and recording patient general information, history of patient health issues and clinical data, patient care procedures and treatments.	●	○	○
Competency in designing preventive care treatment plan: The skills to perform and implement the preventive care plan that is tailored to patient health issues for monitoring and evaluating patient improvement.	●	○	○
Competency in supporting and bonding among healthcare practitioners: The skills to facilitate working relationship among colleagues that is transformed to patient care and commitment.	○	●	○
Competency in skills development and teambuilding among healthcare practitioners: The skills to communicate effectively, convince colleagues and patients, develop, improve and share knowledge among healthcare practitioners in delivering preventive care service.	○	●	○
Competency in hospital information system proficiency: The skills to use IT effectively and integrate information in delivering preventive care service.	○	○	●
Competency in providing education and counselling for patient and family members: The skills to provide awareness, understanding and guidance on patient chronic diseases, medication and devices, and encouraging the carer to be involved in patient care.	●	○	○

Note: IT = information technology

Legend:
 ● Major impact
 ○ Minor impact

Table 5.2: Summary of information system capabilities

Information system capabilities
<p>Capability in managing patient profiling refers to the hospital's potential to use patient profiling during the patient care process to deliver preventive care services.</p> <p>This capability is developed when the healthcare practitioners collaborate and apply 1) <i>competency in patient medical information management</i> and 2) <i>competency in supporting and bonding among healthcare practitioners</i>, thus leading to the formation of this capability.</p> <p>Capability in investigating and diagnosing patient health condition refers to the hospital's potential in performing accurate diagnostic tests that lead to the discovery of patient diseases.</p> <p>This capability is developed when healthcare practitioners take part in performing their roles that result in the combination of 1) <i>competency in patient medical information management</i> 2) <i>competency in supporting and bonding among healthcare practitioners</i> and 3) <i>competency in hospital information system proficiency</i>.</p> <p>Capability in mapping patient health conditions to the right type of preventive care refers to the hospital's potential to use the evidence from investigation and diagnosis for the preventive care patient treatment plan, provide preventive care treatment and assess patient treatment delivered.</p> <p>This capability is developed when healthcare practitioner collaboration results in the combination of 1) <i>competency in patient medical information management</i> 2) <i>competency in designing preventive care treatment plan</i> 3) <i>competency in skills development and teambuilding</i> 4) <i>competency in hospital information system proficiency</i> and 5) <i>competency in providing education and counselling for patients and family members</i>.</p> <p>Capability in sustaining patient health condition refers to the hospital's potential to offer better preventive care and support after being discharged from the hospital.</p> <p>This capability is developed from the effort of doctors, nurses, pharmacists, physiotherapists and dieticians. The group effort of healthcare practitioners results in a combination of 1) <i>competency in supporting and bonding among healthcare practitioners</i> and 2) <i>competency in providing education and counselling for patient and family members</i>.</p>

Note: IS = information system; IT = information technology

5.2 Developing capability in managing patient profiling in Process 1

Figure 5.2 shows the development of IS capability: *capability in managing patient profiling* in Process 1: patient registration that is developed through IS competency and capability bundling to achieve preventive care performance. The findings shown in Figure 5.2 start with how IS capabilities leverage preventive care performance (box with yellow colour), followed by how the IS capabilities are made up through IS capability bundling (box with green colour) and how the case identifies IS resources to develop specific IS competencies through IS competency bundling (box with red and green shaded colour). Figure 5.2 thus is explained in Sections 5.2.1 to 5.2.3, with each section showing a piece of the figure.

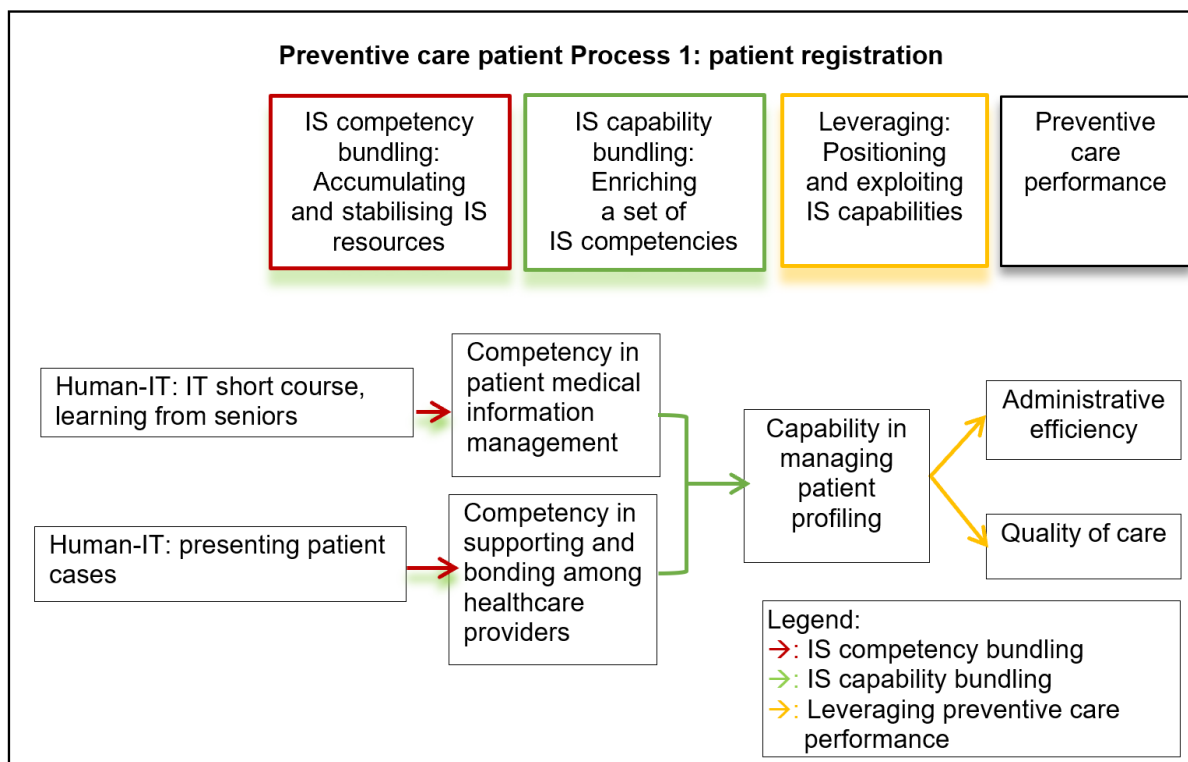


Figure 5.2: Developing capability in managing patient profiling

Note: IS = information system; IT = information technology

5.2.1 Leveraging information system capability for preventive care in Process 1

As shown in Figure 5.2, during Process 1: patient registration, ABC leverages its IS capability: *capability in managing patient profiling* through positioning and exploiting this capability to achieve administrative efficiency and quality of care. *Positioning*

refers to how the hospital matches and leverages its internal IS capabilities with Process 1 to achieve preventive care performance (Chatzkel 2002). *Exploiting* refers to using, developing (Levinthal & March 1993), refining and extending existing IS competencies (March 1991) within the hospital's limited resources to positively and accurately improve each patient process to achieve efficient and effective preventive care performance.

This section details Process 1 and how the associated IS capability is leveraged to achieve two preventive care performance indicators – administrative efficiency and quality of care.

The patient registration process at ABC Hospital marks the beginning of the hospital providing quality of care to patients. During this process, healthcare practitioners gather the patient's previous medical history, medication consumption, lifestyle, nature of work, eating behaviour, family health history and other related information that is used to produce a comprehensive patient profile. At this point, the patient profile produced by HIS is crucial because knowledge about the patient may help healthcare practitioners to administer quality preventive care services (Bill et al. 2013).

For instance, to achieve administrative efficiency, ABC positions its IS capability: *capability in managing patient profiling* with Process 1: patient registration (refer to Figure 5.2). By doing so, the hospital is able to exploit this capability to provide sufficient patient information for the doctors to give orders and plans to the nurses. In turn, the nurses are able to perform specific health procedures, such as blood tests, computed tomography (CT) scans and preparing the patient to undergo their next treatment thus achieve administrative efficiency.

Nurse R #16: Also, having the patient profile enables our nurses to assist the patient during the care process such as managing patient procedures for scanning, blood tests, preparing relevant medication and a suitable diet efficiently.

Moreover, the capability in managing patient profiling is exploited to enable healthcare practitioners to update and produce complete patient information using HIS. With complete patient health information, healthcare practitioners are able to identify any serious indications of the patient. This may increase the likelihood of patient safety, thus promoting the quality of care.

Dr H #22: Basically, with complete patient history, we get the idea, the story and importantly every healthcare practitioner becomes aware of the patient and their condition, thus improving patient safety during the care process.

This is consistent with the suggestion that the ability to manage a patient's profile may facilitate communication, interaction and information delivery between the doctor and the patient, thus allowing healthcare practitioners to manage their health problems and provide quality treatment to patients with chronic diseases (Gorini et al. 2015).

In summary, leveraging the IS capability: *capability in managing patient profiling* through positioning and exploiting the capability in Process 1: patient registration helps to achieve two of the preventive care performance indicators – administrative efficiency and quality of care. The following sections elaborate on how this IS capability is developed from IS capability and competency bundling.

5.2.2 Information system capability bundling: Enriching a combination of competencies to develop capabilities

As shown in Figure 5.2, in Process 1: patient registration, the IS capability: *capability in managing patient profiling* is developed through capability bundling by enriching a combination of IS competencies. *Enriching* refers to the process of extending current IS capabilities (Sirmon, Hitt & Ireland 2007) through a collective of IS competencies. The competencies involved are 1) *competency in patient medical information management* and 2) *competency in supporting and bonding among healthcare practitioners*. The following elaborates the IS competencies that were enriched to develop the IS capability.

The competency in patient medical information management (as shown in Figure 5.2) refers to the capacity of healthcare practitioners to organise patient health information, which involves gathering and recording the patient's general information, history of their health issues and clinical data to document an accurate and detailed patient profile. This competency is crucial to ABC healthcare practitioners to reduce misrepresentation of patient information, such as falsification, distortion and taking words out of context (Galasi & Ziółkowska 2013). Any misrepresentation of what happened while gathering patient data may give an inaccurate picture of the patient and their distress (Galasi & Ziółkowska 2013).

During Process 1, the competency in patient medical information management is used to organise patient information by gathering, recording, storing and documenting information electronically in HIS to be used in subsequent care processes. The information consists of general medical information, such as the patient's physical examination, related health check-ups and previous health issues, as well as information about the patient's lifestyle, working environment and family health history. This competency is crucial; other than assisting healthcare practitioners to play their role in asking questions and interviewing patients with chronic diseases, it also helps to create trust between healthcare practitioners and patients. When healthcare practitioners and patients have trust, patients feel safe and confident to disclose information about their health problems, thus enabling healthcare practitioners to get a comprehensive information overview (Soderstrom, Eriksson & Ahfeldt 2016). One nurse commented:

Nurse R #16: We must have accurate patient data. To have this, our nurses in charge will carefully ask patients and their family members to provide us with patient general information and most importantly the patient's previous health issues and current problem. Usually, we receive patients with an established chronic disease such as diabetes. Other than gathering information on that patient, we also need to know if any of the patient's family members have the same disease. If yes, we must note this in the HIS for further action, such as advising the person to do screening and regular health check-ups. The information will help us to produce a detailed patient profile that is shared among our doctors.

The competency in supporting and bonding among healthcare practitioners (as shown in Figure 5.2) refers to the capacity of healthcare practitioners to develop a working relationship in the hospital. This competency is essential during Process 1, because the commitment and responsibility of the healthcare practitioners enables them to communicate and obtain important information for patient profiling, thus expediting the care process. Sufficient information is vital for healthcare practitioners to quickly determine the patient's condition and plan for the next preventive care treatment. By completing their roles and supporting each other, senior and junior doctors collect the information needed for chronic disease patient profiling. This competency is essential for healthcare practitioners in gathering sufficient patient information to understand and determine the patient's health problem. For example, a patient usually cannot provide accurate information to doctors as most do not realise that they suffer severe

complications from established chronic diseases. A doctor commented on how this competency helps him when attending chronic disease cases during the preventive care registration process:

Dr M #21: Patients that come to the hospital with chronic diseases usually come to the emergency department without knowing they have this disease. The typical case is they come to emergency having this problem or that problem, and the patient is seen by emergency department doctors. Let's say a patient has this kind of problem and feels pain in his abdomen. The junior doctor will examine him and refer him to the medical officer in charge in the emergency department for the day for further examination. Usually the junior doctor at ED [emergency department] will clerk, get the history, do initial examination, and present and discuss with the medical officer.

In summary, enriching a combination of IS competencies consisting of 1) *competency in patient medical information management* and 2) *competency in supporting and bonding among healthcare practitioners* during Process 1 contributes to the development of capability in managing patient profiling.

5.2.3 Information system competency bundling: Accumulating and stabilising resources to develop competencies

As shown in Figure 5.2, in Process 1: patient registration, the IS competencies 1) *competency in patient medical information management* and 2) *competency in supporting and bonding among healthcare practitioners* are developed through competency bundling by accumulating and stabilising IS resources. *Accumulating* IS resources refers to a process of developing IS competencies internally (Sirmon et al. 2011). *Stabilising* refers to a process of making minor incremental improvements to IS resources to develop IS competencies (Sirmon et al. 2011). The following elaborates how each of the IS competencies is accumulated and stabilised from IS resources.

The competency in patient medical information management is developed from human-IT resources. Human-IT resources are accumulated when healthcare practitioners attend IT short courses to enhance their IT skills and knowledge about how to collect and record patient data correctly. Stabilising occurs when the knowledge and skills obtained from the course enable the doctors and nurses to improve their skills in recording patient data systematically, reducing paperwork, avoiding multiple data entries for the same patient and producing comprehensive patient profiles.

Nurse Ms #15: We went for IT short courses organised by the IT department which is compulsory for all healthcare practitioners who work at ABC. During the course, the IT officers guided us on how to use the HIS system. It is step-by-step training which enables us to understand and familiarise ourselves with the HIS interfaces, functions and how the system can generate useful reports.

Furthermore, the accumulation of human-IT resources occurs when healthcare practitioners use their own initiative to learn how to use HIS from seniors. With a step-by-step learning approach from seniors, stabilising of knowledge and skills occurs whereby healthcare practitioners are able to expand their existing IT skills, resulting in the development of this competency.

A senior nurse explained:

Nurse Mn #14: To become skilled in using HIS especially for specific HIS functions, we learn to use HIS from our seniors and practice the HIS at the ward.

The competency in supporting and bonding among healthcare practitioners (as shown in Figure 5.2) is developed from this human-IT resources. Human-IT resources are accumulated when healthcare practitioners present patient cases in front of senior doctors so they critically understand and familiarise themselves with the patient's case. Stabilising occurs when healthcare practitioners continuously practise presenting patient cases, thus strengthening their skills in identifying important patient information. This results in minor incremental improvements to presentation skills, and contributes to the development of the competency in supporting and bonding among healthcare practitioners. According to a doctor in the surgical department:

Dr H #22: Presenting patient cases involves juniors and seniors. It is a process to prepare ourselves to become good doctors. This is how the seniors want us to really get to know our patient. Like the patients are inside our head. We think of them always. This is how we know if the patient information is sufficient or not for treatment planning and patient care. Because, when we're presenting, we must present the case critically. Although we rely on the patient's profile in the HIS, we must ask the patient again if we find that the information is insufficient, maybe they still didn't tell us everything or we want to clarify something.

In summary, accumulating and stabilising human-IT resources (such as participating in IT short courses, learning from seniors and practising presenting patient cases)

during Process 1 contributes to the development of 1) *competency in patient medical information management* and 2) *competency in supporting and bonding among healthcare practitioners*.

5.3 Developing capability in investigating and diagnosing patient health conditions in Process 2

Figure 5.3 shows the development of the IS capability: *capability in investigating and diagnosing patient health condition* in Process 2: patient investigation and diagnosis that is developed through IS competency and capability bundling to achieve preventive care performance. The findings shown in Figure 5.3 start with how IS capabilities leverage preventive care performance (box with yellow colour), followed by how the IS capabilities are made up through IS capability bundling (box with green colour) and how the case identifies IS resources to develop specific IS competencies through IS competency bundling (box with red and green shaded colour). Figure 5.3 thus is explained in Sections of 5.3.1 to 5.3.3, with each section showing a piece of the figure.

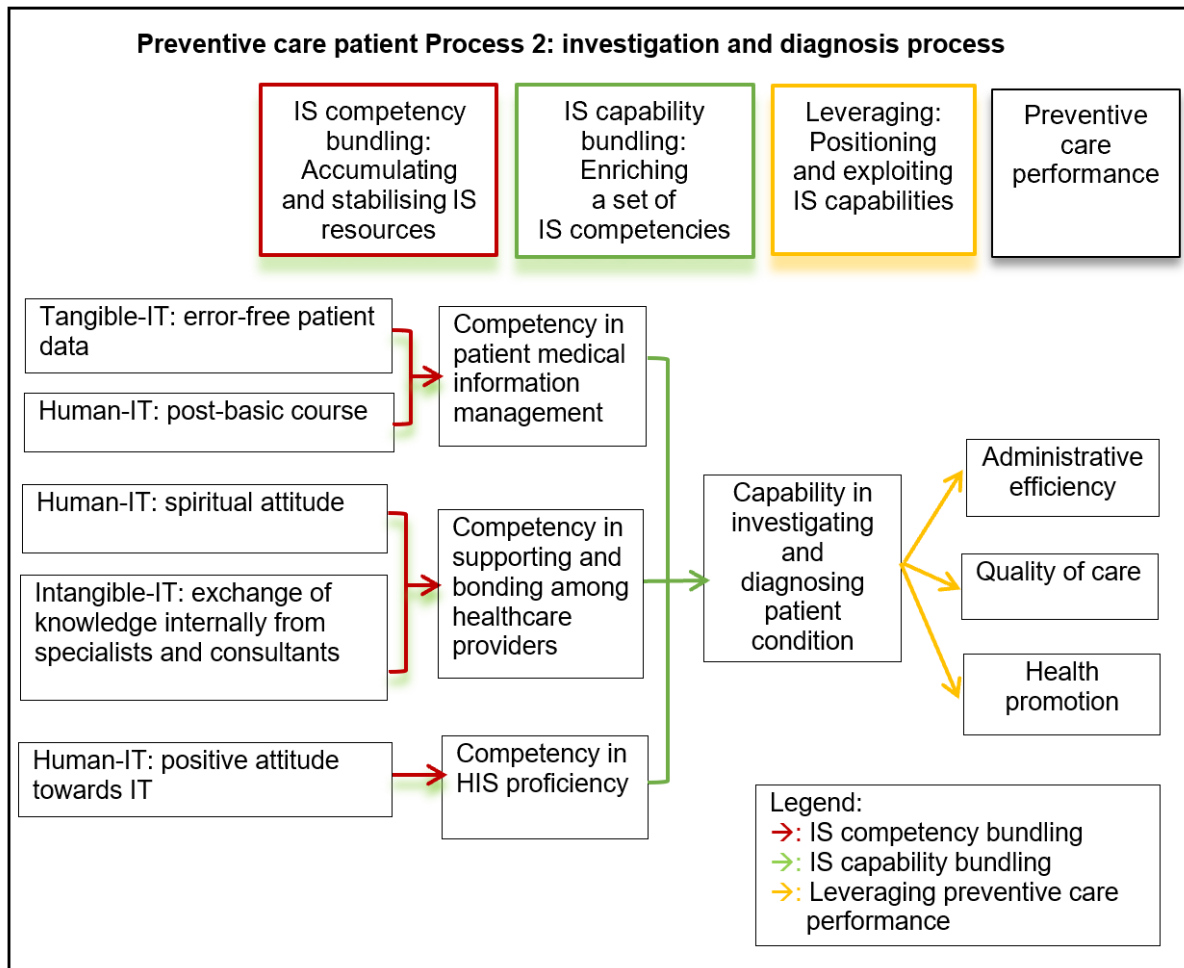


Figure 5.3: Developing capability in investigating and diagnosing patient health condition

Note: IS = information system; IT = information technology

5.3.1 Leveraging information system capability for preventive care in Process 2

During Process 2: patient investigation and diagnosis, ABC leverages its IS capability: *capability in investigating and diagnosing patient health condition* through positioning and exploiting the capability to achieve administrative efficiency, quality of care and health promotion. *Positioning* refers to how the hospital matches and leverages its internal IS capabilities with the preventive care patient process to achieve preventive care performance (Chatzkel 2002). *Exploiting* refers to using, developing (Levinthal & March 1993), refining and extending existing IS competencies (March 1991) within the hospital's limited resources to positively and accurately improve each preventive case patient process to achieve efficient and effective preventive care performance.

This section explains Process 2 and how the associated IS capability is leveraged to achieve three preventive care performance indicators – administrative efficiency, quality of care and health promotion.

In this process, ABC healthcare practitioners investigate patients who are already showing signs and/or symptoms of a disease by carrying out relevant laboratory tests for diagnosis (Fleischer et al. 2009). The results of the investigation are recorded in the HIS system for easy access.

Dr M #21: The laboratory does all the blood investigation, the white blood cells, the haemoglobin, so this is all the levels, so we can see it straight away from the HIS.

Next, ABC healthcare practitioners perform clinical diagnosis, which refers to analysing the patient's test results and examining the patient for detection and referral, and to guide treatment planning (Handler 2008; Mitchell et al. 2008). Most cases at ABC are referrals of patients who are in the early stage of chronic disease, but they also have patients who have late-stage established chronic diseases, such as diabetes, hypertension, asthma and cancer. The objective of Process 2 is to deliver a better clinical diagnosis and provide adequate information and disclosure of the diagnosis (Jie et al. 2016), reduce diagnosis delay (Harirchi et al. 2015) and errors in the diagnostic process, thus avoiding misdiagnosis (Miller & Levy 2015; Neale, Hogan & Sevdalis 2011). Diagnosis delay is defined as specified period between the first medical visit for the symptoms and the diagnosis of the chronic disease (Harirchi et al. 2015).

To achieve administrative efficiency and quality of care, ABC Hospital positions its IS capability: *capability in investigating and diagnosing patient health condition* with Process 2 (refer to Figure 5.3). Concurrently, the hospital is able to exploit the capability to support patient management and determine care (Anderson 2017) especially for patients who have an advanced stage of chronic disease. Hence, this capability helps the hospital to provide a service to patients with late diagnosis who still have the chance to receive care and treatment, reduce the risks of complications and fight for survival, although it might result in limited clinical interventions in cases such as cancer (Maughan, Lutterbie & Ham 2010). For example, doctors show how they assist patients in performing certain procedures and provide investigation results

for the specialist to review. This may improve patient health management and influence the next treatment plan, which contributes to administrative efficiency and quality of preventive care.

Dr M #21: Like what I explained before, patients with cancer will go through CT TAP or CT 'Torex, Abdomen Pelvis' [scan] to see the whole body and identify where cancer has spread. So, this will help in staging. From the result, the specialist will determine further treatment plan either operation or other alternatives. [Staging is the process of finding out how much cancer is in a person's body and where it is located. It is how the doctor determines the stage of a person's cancer].

Other than managing patient health, ABC is also concerned about managing their emotions. For certain chronic diseases such as cancers, the breaking of sad news from the diagnosis impacts patient and family member emotions, and they feel devastated, shocked or anxious (Engebretson, Matrisian & Thompson 2015). To achieve quality of care, ABC Hospital exploits the *capability in investigating and diagnosing patient health condition* to provide emotional support, which is helpful for patients to build and maintain trust in their doctors and is helpful for patients to maintain hope for their lives (Cao et al. 2017), thus may achieve quality of care. As one interviewee said:

Dr T #11: Sometimes because of the advanced stage of their disease they don't know how to talk about that. I need to give them time, after explaining what is happening to the patient and give them time, slowly they will talk. Show them you really care, break the barrier. Like this old-age patient, he finds it hard to talk about himself and the disease because he suffers with advanced stage of rectal cancer.

Thus, this capability facilitates ABC's patient management to focus on the need for empathy. For instance, when initially disclosing a cancer diagnosis, healthcare practitioners deliver the news with utmost sensitivity. There are many ways to deliver the news to patients, be it in person or in the presence of supportive family members, but the most crucial element is that healthcare practitioners' honesty should be moderated with empathy when communicating the news (Islam et al. 2016).

Furthermore, a patient who has been diagnosed with a chronic disease may indirectly help healthcare practitioners to advise their family members to seek early screening and diagnosis services. Early diagnosis could potentially affect a patient's lifestyle, for

example by changing their physical activity (Dontje et al. 2016), improving their knowledge about a healthy diet, valuing themselves (Pakseresht et al. 2010), and could serve as one approach in improving their quality of life (Chen et al. 2012) and decreasing the risk of getting other complications from a chronic disease. To achieve quality of care, ABC exploits the *capability in investigating and diagnosing patient health condition* to implement better investigation and diagnosis by not only involving interaction between healthcare practitioners and patients, but also by having an overall understanding about the patient's current disease and their family health history, the social factors that cause the chronic disease, and an overview of alternatives and plans to treat and improve patient health issues (Brown, Lyson and Jenkins 2011). As one of the consultants put it:

Dr S #37: Like one of my patients today came for liver cancer. I asked in detail if any family members have malignancies, they answer yes, my dad died of having this, my sister has breast cancer and another sister got possible breast cancer. So, I said ok, in that case, your family has a genetic tendency to have cancers so all the family members must start screening from an early age rather than wait for the symptoms to come.

Overall, the *capability in investigating and diagnosing patient health condition* is vital for healthcare practitioners in investigating and diagnosing because it considers current, past and future conditions that helps healthcare practitioners have an inclusive view of patients presenting with chronic disease – the social factors, the symptoms, disease stage and the required services (Brown, Lyson & Jenkins 2011) that are needed by the patient and their family members, thus improving quality of care.

In most situations, ABC receives referral cases of patients with established symptoms and signs of chronic diseases that require further investigation and clinical diagnosis for confirmation. This is because chronic diseases are generally detected at advanced stages when a cure is not possible (Mittra 2011). Despite receiving patients who suffer with advanced stages of chronic diseases, ABC is active in organising awareness campaigns and screening people for early detection, thus may achieve the third preventive care performance indicator for this capability – health promotion.

For example, to achieve health promotion, ABC positions the capability in investigating and diagnosis patient health condition with Process 3 (refer to Figure 5.3). Further, ABC is able to exploit this capability to organise awareness campaigns and programs

for inpatients and the public through collaboration between the health-education unit and the clinical department. Awareness campaigns and programs are useful because the events offer knowledge about preventive care for chronic diseases, the risk factors and symptoms, and most importantly, the programs provide education, screening tests and general counselling services as the first step to convince the public to obtain further investigation and diagnosis for disease confirmation, leading to better treatment options and follow-up (Mittra 2011). Doctor and nurse expertise is involved in such awareness campaigns, where they meet patients and the public to deliver talks, seminars, free advice and answers to questions about preventive care for chronic diseases. One of the doctors described a breast cancer awareness campaign.

Doctor T #11: This month, our department opened this booth [at the hospital main lobby] to promote a breast cancer campaign. The main aims of this campaign are to raise awareness about breast cancer amongst the Malaysian public and promote a healthy lifestyle. We also offer expert advice and screening services to existing patients and the public.

In summary, leveraging the IS capability: *capability in investigating and diagnosing patient health condition* through positioning and exploiting the capability in Process 2: patient investigation and diagnosis, helps to achieve the three preventive care performance indicators of administrative efficiency, quality of care and health promotion. The following sections elaborate on how this IS capability is developed from IS capability and competency bundling.

5.3.2 Information system capability bundling: Enriching a combination of competencies to develop capabilities

As shown in Figure 5.3, in Process 2: patient investigation and diagnosis, the IS capability: *capability in investigating and diagnosing patient health condition* is developed through capability bundling by enriching a combination of IS competencies. *Enriching* refers to the process of extending current IS capabilities (Sirmon, Hitt & Ireland 2007) through a collective of IS competencies. The IS competencies involved are 1) *competency in patient medical information management*, 2) *competency in supporting and bonding among healthcare practitioners* and 3) *competency in HIS proficiency*. The following elaborates the IS competencies that were enriched to develop the IS capability.

The competency in patient medical information management is essential in this process because it enables healthcare practitioners, especially doctors, to properly organise information on patient investigation procedures, investigation results and diagnosis that may help them order the right laboratory tests, which are critical to diagnosis and treatment, thus helping to avoid misdiagnosis (Schiff et al. 2005). This competency enables healthcare practitioners to manage records in HIS for laboratory tests, such as ordering blood tests.

Dr H #22: The system helps in blood order tasks. It is systematic. When we want to do a specific blood test, there is a particular tube that we can use. After we order, we can print out the sticker and paste it on the tube. We don't need to write anything because the details are printed out on that sticker.

The competency in supporting and bonding among healthcare practitioners (as shown in Figure 5.3) is applied to support a working relationship between junior and senior doctors in carrying out investigation and diagnosis procedures. This competency is applied by senior doctors to guide junior doctors to be responsive and take steps to counteract their intuitive thoughts in making a diagnosis. Nevertheless, if there is still doubt, a second opinion should come from a more experienced clinician who must be prepared to analyse the problem without being biased by previous assessments (Neale, Hogan & Sevdalis 2011). To have an accurate diagnosis may require integrating correct clinical findings with appropriate investigations and framing conclusions accurately, which requires reflection, discussion and reconsideration between healthcare practitioners (Neale, Hogan & Sevdalis 2011).

Dr M #21: Juniors may have made a decision but it is something that does not relate to big issues/things. But any decisions that may have significant impacts will come from the specialist and consultants.

Since the investigation is an essential process that will determine the accurate diagnosis of the patient's chronic disease stage and the beginning of the solutions and treatment plan offered, proficiency in using HIS is vital to ensure that the investigation and diagnosis can be completed quickly and produce an accurate result. Competency in HIS proficiency as shown in Figure 5.3, encourages the use of HIS in ABC that not only enables healthcare practitioners to receive quick access to laboratory results, but also enables them to analyse the information that is systematically generated from the system to understand the patient's current health condition, thus providing accurate

diagnosis (Monsted 2018). The following quote shows healthcare practitioners have easy access to the relevant investigation results.

Nurse Mn #14: For example, from the ordering of a full blood count, the HIS systematically could provide us with important information. What do we want to find out? How many the Hb [haemoglobin]? Does this patient have anaemia? How many platelets do these patients have? We can view the status of the blood order, whether it is still in the lab, in progress or the blood result is completed. If the result shows completed, we can quickly analyse the result and determine our patient's current health issues.

In summary, enriching a combination of the IS competencies of 1) *competency in patient medical information management* 2) *competency in supporting and bonding among healthcare practitioners* and 3) *competency in HIS proficiency* during Process 2 contributes to the development of the capability in investigating and diagnosing patient health condition.

5.3.3 Information system competency bundling: Accumulating and stabilising resources to develop competencies

As shown in Figure 5.3, in Process 2: patient investigation and diagnosis, the IS competencies 1) *competency in patient medical information management* 2) *competency in supporting and bonding among healthcare practitioners* and 3) *competency in HIS proficiency* are developed through IS competency bundling by accumulating and stabilising IS resources. *Accumulating* IS resources refers to a process of developing IS competencies internally (Sirmon et al. 2011). *Stabilising* refers to a process of making minor incremental improvements to IS resources to develop IS competencies (Sirmon et al. 2011). The following elaborates how each of the IS competencies is accumulated and stabilised from IS resources.

The competency in patient medical information management is developed from tangible and human-IT resources. A tangible-IT resource is accumulated when HIS is designed to provide faster diagnosis and produce systematic results for the use of healthcare practitioners. With this highly automated function, the system is stabilised when it supports healthcare practitioners by providing error-free patient data, saving time and matching patients (Devaraj, Ow & Kohli 2013) with the highest quality of diagnosis, thus contributing to the development of this competency.

Nurse Mn #14: The HIS enables healthcare practitioners to log in and from there the user is able to order a blood test. Also, the user can check the status of the blood order, whether it is still in the lab, in progress or the blood result is completed. If the result shows a sign that it is completed, the user can view and check the result straight away.

Furthermore, the human-IT resource also contributes to the development of this competency. The human-IT resource is accumulated when healthcare practitioners such as nurses pursue a post-basic course – a specialised course that requires nurses to attend a six-month program that consists of practical, exams and management in the specialised field in order to be a professional nurse (Nkosi, Asah & Pillay 2011). Stabilising occurs when the nurses develop themselves as knowledgeable and skilful in a specific area by intensively learning new methods and skills for effective patient care, thus applying their knowledge gain into preventive care practice. A nurse explained:

Nurse S #31: We gain many experience and new knowledge during the course. It takes six months to complete this course. We do our practical in other hospitals and we learn every procedure, which helps us to have in-depth knowledge and skills in a specific area.

The competency in supporting and bonding among healthcare practitioners (as shown in Figure 5.3) is developed through human and intangible-IT resources. The human-IT resource is accumulated when the healthcare practitioners are able to show their spiritual attitude (Ramezani et al. 2016) when delivering preventive care to patients. A doctor from the surgical department commented on spiritual attitude:

Dr N #9: When working as a team, I believe in good intentions and effort in delivering the best care to patients. Always remember God and we able to face challenges [people's life and death] and therefore each one of us may provide better care to patients.

Stabilising occurs when the spiritual attitude that is embedded in the healthcare practitioners enables them to identify and properly meet their patients' spiritual needs, alleviate their stress and increase their calmness, thus enabling them to support each other in providing effective care (Ramezani et al. 2016), resulting in the development of this competency.

Nurse H #29: in terms of spiritual actions, we assist patients [with diabetes and stroke] to perform their prayers. We give them support,

we know how they are feeling, we understand what they have gone through, that's why we always encourage them to be strong and always pray to God so that they will always be strong to go through this.

This competency in supporting and bonding among healthcare practitioners (refer to Figure 5.3) is also developed from intangible-IT resources, which are accumulated when there is an exchange of knowledge internally from specialists and consultants to junior doctors (Chung & Yoon 2015). Stabilising occurs when specialists and consultants exchange knowledge to enable juniors to obtain unique values that reside within the expertise of specialists' and consultants' specific skills, knowledge, experience and attitudes, thus preparing juniors for their future as specialists and consultants with vast knowledge and experience (Chung & Yoon 2015). A junior doctor from the surgical department described how specialists exchange their skills with juniors, thus contributing to the development of the competency in supporting and bonding among healthcare practitioners:

Dr H #22: The scan usually appears quickly in the system. Sometimes, specialists view and analyse the scan without even waiting for the scan report by a radiologist. The scan can be in the form of an X-ray, CT scan, MRI etc. generated from the HIS. Analysing the scan requires skills. As a junior doctor, when I view the scan I kind of miss something, but for specialists they are very fast, they know. So, there are a lot of things that I would still need to learn from them. Because this requires skills and more to experience.

The competency in HIS proficiency (as shown in Figure 5.3) is developed from human-IT resources. The human-IT resource is accumulated when healthcare practitioners demonstrate a positive attitude towards IT (Barakat et al. 2013). Stabilising occurs when ABC encourages its staff to continuously use HIS in all aspects of care so that their ability to use it becomes one of their main responsibilities. Thus, being positive towards IT could motivate healthcare practitioners to utilise HIS and improve the efficiency of preventive care service to patients. For example:

Dr T #11: The new generation nowadays has exposure to computers. I mean even at home, you use a computer, the internet for example. In ABC, I join IT short courses and have orientation, I find the HIS is a user-friendly system. With all these, I just know that I need the system to support us.

In summary, accumulating and stabilising tangible-IT resources (such as HIS with an automated function for error-free patient data), human-IT resources (such as post-basic courses, spiritual attitude, positive attitudes towards IT) and intangible-IT resources (such as exchange of knowledge internally from specialists and consultants) during Process 2 contributes to the development of 1) *competency in patient medical information management* 2) *competency in supporting and bonding among healthcare practitioners* and 3) *competency in HIS proficiency*.

5.4 Developing capability in mapping patient health condition to the right type of preventive care in Process 3

The capability in mapping patient health condition to the right type of preventive care is developed through a combination of IS competencies in three preventive care patient processes – Process 3: patient evaluation after investigation and diagnosis; Process 4: patient treatment and monitoring; and Process 5: patient evaluation after treatment and monitoring. To show how this capability is developed, the following sections are organised such that each section (Sections 5.4, 5.5 and 5.6) separately elaborates this capability development in each of the three preventive care patient processes.

In this section, Figure 5.4 shows the development of IS capability: *capability in mapping patient health condition to the right type of preventive care* found in one of the preventive care patient processes (Process 3). The findings shown in Figure 5.4 start with how IS capabilities leverage preventive care performance (box with yellow colour), followed by how the IS capabilities are made up through IS capability bundling (box with green colour) and how the case identifies IS resources to develop specific IS competencies through IS competency bundling (box with red and green shaded colour). Figure 5.4 is explained in Sections of 5.4.1 to 5.4.3, with each section showing a piece of the figure.

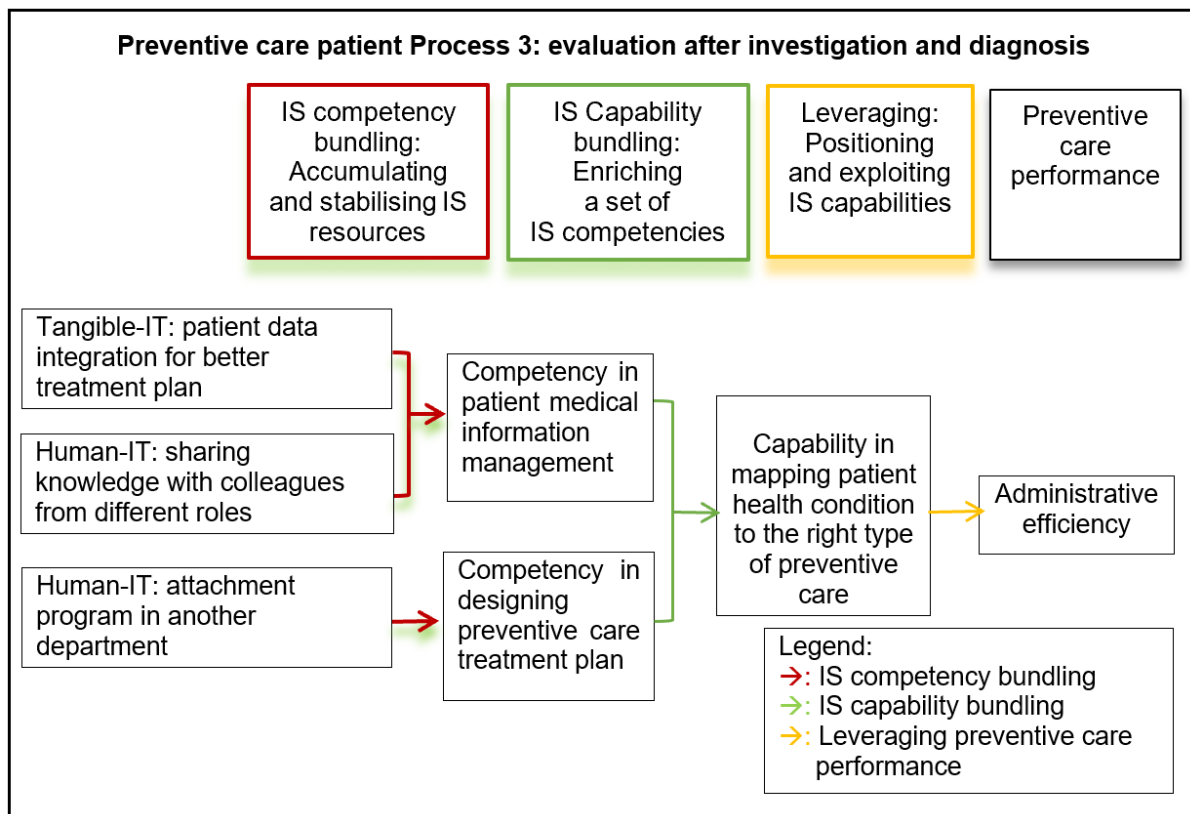


Figure 5.4: Developing capability in mapping patient health condition to the right type of preventive care in Process 3

Note: IS = information system; IT = information technology

5.4.1 Leveraging information system capability for preventive care in Process 3

As shown in Figure 5.4, during Process 3: patient evaluation after investigation and diagnosis, ABC leverages its IS capability: *capability in mapping patient health condition to the right type of preventive care* through positioning and exploiting this capability to achieve administrative efficiency. *Positioning* refers to how the hospital matches and leverages its internal IS capabilities to the preventive care patient process to achieve preventive care performance (Chatzkel 2002). *Exploiting* refers to using, developing (Levinthal & March 1993), refining and extending existing IS competencies (March 1991) within the hospital's limited resources to positively and accurately improve each preventive case patient process to achieve efficient and effective preventive care performance.

This section explains Process 3 and how the associated IS capability is leveraged to achieve one of the preventive care performance indicators – administrative efficiency.

In this process, ABC Hospital delivers and uses the diagnosis results to provide adequate information on treatment options and outcomes to patients (Moxey et al. 2003). To achieve administrative efficiency, ABC Hospital positions its IS capability: *capability in mapping patient health condition to the right type of preventive care* with Process 3 (refer to Figure 5.4). As a result, healthcare practitioners are able to exploit the capability to create a treatment plan, guide the patient to choose and decide on the best alternative treatments and procedures that suit the patient, and to respect the patient's right to refuse treatment (Mendick et al. 2010). This allows healthcare practitioners to become advocates that patients can trust and obtain guidance from for treatment options (Islam et al. 2016).

Dr S #37: I have been in this department for more than 20 years. What I can see now is patients nowadays are more well informed. Probably because of the internet, therefore they can easily access information regarding treatment. Let's say patients with cancer of the pancreas. When they come, they have a lot of questions. They have already read about a treatment option, thus it's our job to guide them on the best alternatives that we can provide. Rather than previously, when we explained just the basics, like telling the patient this is the organ, this is what we call the organ, now we explain in detail. For example, we show them which organ is involved and which one has been impacted by the disease. We also provide patients with treatment alternatives, explain the risks and the outcomes for each of the options so that the patient can have sufficient information to decide.

After the patient has chosen the treatment plan, the healthcare practitioners can proceed to Process 4, which is explained further in Section 5.5.

In summary, leveraging the IS capability: *capability in mapping patient health condition to the right type of preventive care* through positioning and exploiting this capability in Process 3: evaluation after investigation and diagnosis, helps to achieve one of the preventive care performance indicators – administrative efficiency. The following sections elaborate on how this IS capability is developed from IS capability and competency bundling.

5.4.2 Information system capability bundling: Enriching a combination of competencies to develop capabilities

As shown in Figure 5.4, in Process 3: patient evaluation after investigation and diagnosis, the IS capability *mapping patient health condition to the right type of*

preventive care is developed through capability bundling by enriching a combination of IS competencies. *Enriching* refers to the process of extending current IS capabilities (Sirmon, Hitt & Ireland 2007) through a collective of IS competencies. The IS competencies involved are 1) *competency in patient medical information management* and 2) *competency in designing preventive care patient treatment plan*. The following elaborates the IS competencies that were enriched to develop the IS capability.

In Process 3, a patient is informed about the details of their disease, the treatment alternatives available and the associated risks. The competency in patient medical information management (as shown in Figure 5.4) is applied by healthcare practitioners to better plan for patient treatment by optimising the integrated results from their previously collected patient history, clinical investigation and diagnosis data.

Nurse N #32: With HIS, the diagnosis results, scan reports and investigation results are automatically provided to the doctors. This integrated data could be used by our doctors to assist in planning the patient's treatment procedures. This is important because the ability of doctors to come up with an efficient treatment plan would help to reduce the waiting time for treatment implementation. So, HIS really helps to speed up the preventive care process.

The competency in designing preventive care patient treatment plan (refer to Figure 5.4) is crucial because this competency aids healthcare practitioners to interact, discuss and educate patients about the current state of their disease, any treatment options and the impact of the treatment plan of the patient's preferred choice, thus producing information dissemination that creates opportunities for the patient to speak to the healthcare practitioners in charge before making a decision for treatment (Heggland et al. 2013). Having an active two-way exchange of information between doctor and patient (Charles, Whelan & Gafni 1999) may influence the positive doctor-patient relationship (Di Cristofaro et al. 2014). Hence, competency in designing a preventive treatment plan is crucial to the healthcare practitioners to ensure information about the treatment plan, treatment options, reasons for the treatment suggested and its implications are well informed, received and understood by the patient (Charles, Whelan & Gafni 1999). This may preserve the patient's right to make an independent informed decision on the treatment available (Nisselle 2013). A doctor described her patient's feedback when discussing the treatment plans for a liver cancer case:

Dr S #37: For me, most of the treatment plan given is in terms of surgery. If you tell the patient, say 'I will take out half of your liver', some of the patients will say: 'Owhh half of my liver? Let me go back first and think about that again'. This will scare them. In this case, I prefer to start telling my patient about the plan nicely. This is how your liver is, because your liver here is still in good condition, the part that I'm going to leave behind is the good part, that's why I will take out the bad part. This is how I educate my patients and encourage them to participate in the discussion so that at the end we come out with the best solution for patients.

In summary, enriching a combination of IS competencies 1) *competency in patient medical information management* and 2) *competency in designing preventive care patient treatment plan* during Process 3 contributes to the development of the capability in mapping patient health condition to the right type of preventive care.

5.4.3 Information system competency bundling: Accumulating and stabilising resources to develop competencies

As shown in Figure 5.4, in Process 3: patient evaluation after investigation and diagnosis, the IS competencies 1) *competency in patient medical information management* and 2) *competency in designing preventive care patient treatment plan* are developed through IS competency bundling by accumulating and stabilising IS resources. *Accumulating* IS resources refers to a process of developing IS competencies internally (Sirmon et al. 2011). *Stabilising* refers to a process of making minor incremental improvements to IS resources to develop IS competencies (Sirmon et al. 2011). The following elaborates how each IS competency is accumulated and stabilised from IS resources.

The competency in patient medical information management is developed from tangible and human-IT resources. A tangible-IT resource is accumulated when HIS is designed to integrate patient data for the treatment plan. For example, to evaluate patients after investigation and diagnosis, healthcare practitioners use the integrated information of medical test results with patient history generated by HIS to allow them to analyse the results to assist in planning the treatment. The integrated data from HIS is stabilised when healthcare practitioners use the data produced for evaluation, such as to evaluate the patient's stage of the disease, and plan and guide the patient for available treatment, thus leading to improved communication among healthcare

practitioners and patients (Adekele et al. 2015; Zakaria & Yusof 2016). This in turn contributes to the development of this competency. For example:

Dr L #7: Definitely it [HIS] is convenient because I can locate particular results quicker although I am at a ward and the result is still at the lab. For instance, as a doctor, I am able to compare the blood investigation or view a particular X-ray and reports, thus these help me to evaluate the medical results quickly and also to discuss with the patient and their family members about the suitable treatment that I have planned for them.

The human-IT resource is accumulated when healthcare practitioners share knowledge from colleagues with different roles, thus broadening each other's knowledge in other areas. Stabilising occurs when healthcare practitioners learn, utilise and integrate the knowledge gained in other areas with their existing knowledge to provide accurate evaluation and discussion for a better treatment plan that involves the patient and family members. For example, in diabetes cases, the pharmacist assists the doctors in medication dosage, thus helping the doctor to update and gain new knowledge to deliver safer care to patients:

Phar Sf #23: We have a drug information service, or now we call it pharmacy information centre. We receive enquiries, usually from our doctors. For instance, the doctor is planning for a diabetic patient's treatment who has kidney or renal problems. So, the doctor would consult us [pharmacists] to get advice, clarify and learn more about medication-related matters.

The competency in designing preventive care treatment plan (as shown in Figure 5.4) is developed from human-IT resources. Human-IT resources are accumulated when healthcare practitioners participate in attachment programs in certain departments. During the attachment program, junior doctors are trained by the consultants, providing the opportunity for junior doctors to develop good characters, acquire knowledge and learn new skills from seniors. As a result, the attachment program is stabilised when the junior doctors gain practical hands-on experience that enables them to be knowledgeable, have good communication skills and the most desirable personality traits for chronic disease care (Dejesus et al. 2012). One of the consultants explained that in ABC, junior doctors are encouraged to do an attachment in certain units because this will help them to learn unique skills and gain new knowledge in a specialised area, thus resulting in the development of the competency in designing preventive care treatment plan.

Dr S #37: We welcome quite a few students coming here for attachment, from the undergraduate who wants to gain experience in hepatobiliary surgery to students who do master surgery. I always remind my students, well if you forget the rest of it, one thing that you should bring back home is always to remind yourself to be 'a good doctor'. Because if you have in your heart 'a good doctor' you will do the right thing. What I mean is you will want to treat the patients under your care as if they are part of your own family. So, you need to be able to master the skills in order to give the best treatment for patients.

In summary, accumulating and stabilising tangible-IT resources (such as HIS with patient data integration) and human-IT resources (such as sharing knowledge from colleagues with different roles and participating in attachment programs) during Process 3 contributes to the development of 1) *competency in patient medical information management* and 2) *competency in designing preventive care treatment plan*.

5.5 Developing capability in mapping patient health condition to the right type of preventive care in Process 4

As described in Section 5.4, the capability in mapping patient health condition to the right type of preventive care is developed from a combination of different IS competencies in three preventive care patient processes. This section continues to explain how this capability is developed in Process 4: patient treatment and monitoring.

Figure 5.5 shows the development of IS capability: *capability in mapping patient health condition to the right type of preventive care* in Process 4. The findings shown in Figure 5.5 start with how IS capabilities leverage preventive care performance (box with yellow colour), followed by how the IS capabilities are made up through IS capability bundling (box with green colour) and how the case identifies IS resources to develop specific IS competencies through IS competency bundling (box with red and green shaded colour). Figure 5.5 is explained in Sections of 5.5.1 to 5.5.3, with each section showing a piece of the figure.

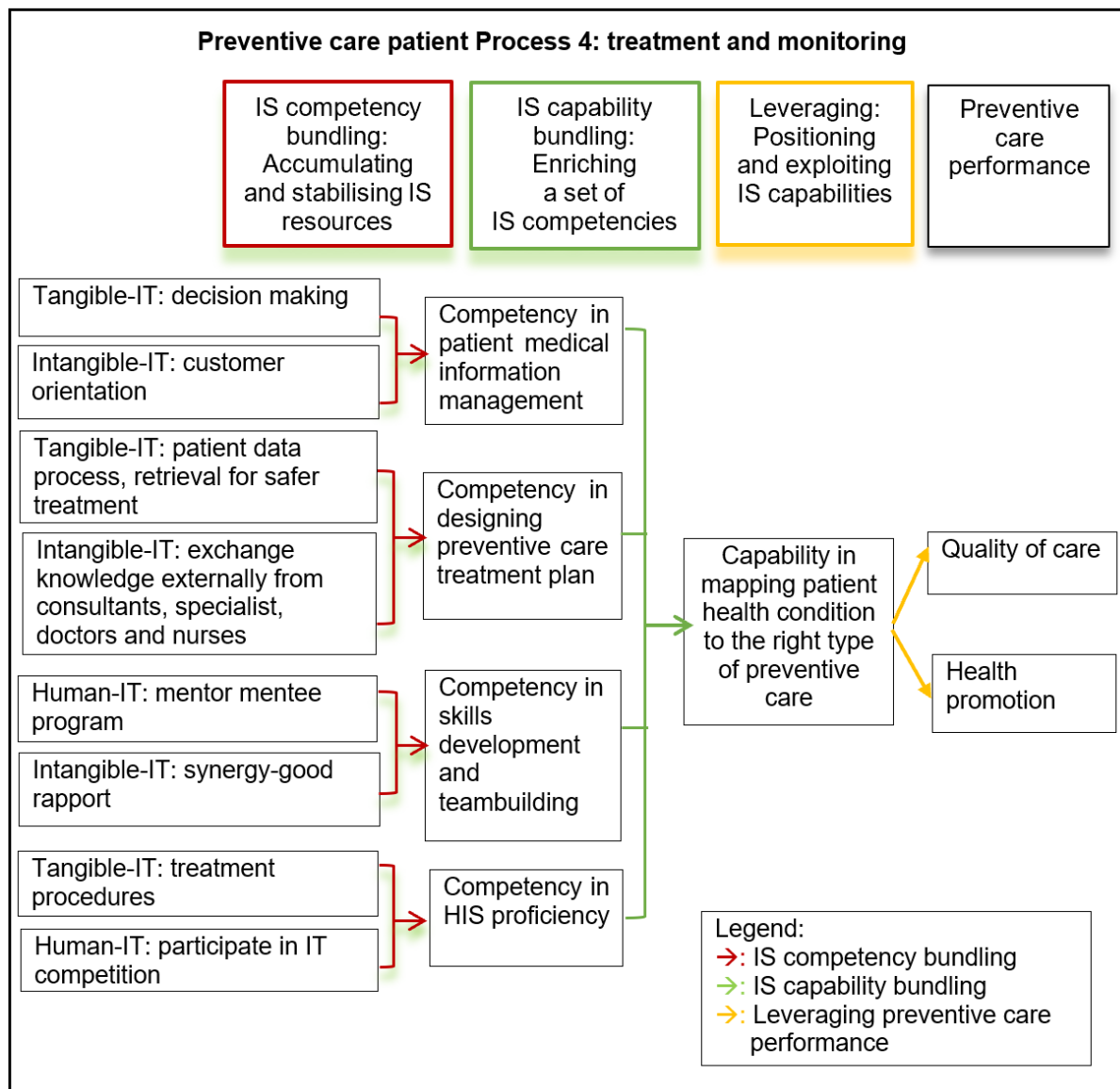


Figure 5.5: Developing capability in mapping patient health condition to the right type of preventive care in Process 4

Note: IS = information system; IT = information technology

5.5.1 Leveraging information system capability for preventive care in Process 4

As shown in Figure 5.5, during Process 4: patient treatment and monitoring, ABC leverages its IS capability: *capability in mapping patient health condition to the right type of preventive care* through positioning and exploiting the capability to achieve quality of care and health promotion. *Positioning* refers to how the hospital matches and leverages its internal IS capabilities to the preventive care patient process to achieve preventive care performance (Chatzkel 2002). *Exploiting* refers to using, developing (Levinthal & March 1993), refining and extending existing IS competencies

(March 1991) within the hospital's limited resources to positively and accurately improve each preventive case patient process to achieve efficient and effective preventive care performance.

This section explains Process 4 and how the IS capability is leveraged to achieve two of the preventive care performance indicators – quality of care and health promotion.

Once the patient has gone through Process 3: patient evaluation after investigation and diagnosis, the outcomes serve as direction for the implementation of Process 4: patient treatment and monitoring. The objective of Process 4 is to provide access to care so patients improve their health, manage existing health conditions and reduce their disease complications. To achieve this objective, ABC has to leverage its specific IS capability.

To achieve quality of care, ABC Hospital positions the *capability in mapping patient health condition to the right type of preventive care* with Process 4 (refer to Figure 5.5). Consequently, the hospital is able to exploit this capability to prepare for the execution of the patient's treatment plan and monitoring, thus enabling patients to have access to a well functioning health system regardless of their social and economic standing (Samb et al. 2010). This quality of care is exemplified in a liver cancer case.

Dr S #37: I told them to stop drinking alcohol. Like they have liver cirrhosis and end up with cancers. If the patient has relatively proper liver function, then there is still hope they will refer to us for treatment. Whether surgery or chemoembolisation [involving the injection of anti-cancer drugs directly into the blood vessel feeding a cancerous tumour. In addition, synthetic material called an embolic agent is placed inside the blood vessels that supply blood to the tumour, in effect trapping the chemotherapy in the tumour].

Other than focusing on individual patient treatment, ABC Hospital also exploits this capability to provide additional services that may strengthen patient treatment, such as referring the patient to an education class and clinics with one-to-one basic counselling to educate them on the symptoms, risks and how to care for chronic diseases, known as health promotion (Srinivas & Paphitis 2016). For instance, doctors refer those with heart problems, diabetes and hypertension to relevant clinics according to their chronic disease, for example to the diabetes or quit-smoking clinic, which may educate and help the patient to control their disease from being worse.

Mr Y: We find it difficult to help our patients if they do not have the willpower to change. However, we work hard to ensure we deliver better service in terms of providing education and counselling to our patients. For example, the quit-smoking clinic always achieves key performance indicators each year, although the challenge is always there in giving awareness to patients. Our counsellor receives referral cases from the doctors related to patients with cardio problems and with a smoking habit. Some of them have shown complications and therefore our counsellor provides counselling on behaviour modification and medication to help them stop smoking.

The treatment delivered during this process is evaluated to ensure the treatment to address patient disease is successful. The evaluation process after treatment and monitoring is discussed in Process 5 and explained further in Section 5.6.

In summary, leveraging the IS capability: *capability in mapping patient health condition to the right type of preventive care* through positioning and exploiting the IS capability in Process 4: patient treatment and monitoring, helps to achieve two of the preventive care performance indicators – quality of care and health promotion. The following sections elaborate on how this IS capability is developed from IS capability and competency bundling.

5.5.2 Information system capability bundling: Enriching a combination of competencies to develop capabilities

As shown in Figure 5.5, in Process 4: patient treatment and monitoring, the IS capability: *capability in mapping patient health condition to the right type of preventive care* is developed through IS capability bundling by enriching a combination of IS competencies. *Enriching* refers to the process of extending current IS capabilities (Sirmon, Hitt & Ireland 2007) through a collective of IS competencies. The IS competencies involved are 1) *competency in patient medical information management* 2) *competency in designing preventive care treatment plan* 3) *competency in skills development and teambuilding* and 4) *competency in HIS proficiency*. The following elaborates each of the IS competencies that were enriched to develop the IS capability.

The competency in patient medical information management is applied by healthcare practitioners to organise and compile correct treatment information, ensure the privacy and confidentiality of patient data, and document patient information to be shared and

used by healthcare practitioners to deliver quality and safer preventive care. In Process 4: patient treatment and monitoring, this competency is used for a different purpose that is applied by healthcare practitioners to minimise clinical and medication errors (Choi et al. 2014) that can cause patient injury and be the source of litigation (Oyebode 2013) during treatment procedures. This involves systematic documentation, which acts as primary evidence in cases where malpractice is alleged against healthcare practitioners (Freckelton 1995). Furthermore, this competency enables healthcare practitioners to ensure compiled records contain sufficient information, the information is safely delivered and interpreted to a particular patient, and the patient has an opportunity to seek clarification from healthcare practitioners if necessary (Nisselle 2013). For instance, this competency facilitates healthcare practitioners to systematically record for medicolegal purposes.

Nurse Mn #14: All information on procedures and actions on a patient in treatment planning and executing are recorded in the system. This is our legal duty for medicolegal. Everything that we do must be recorded. This is the procedure in ABC. The system is useful to support us in documenting activities in nursing progresses such as to record that the patient is sent to OT [occupational therapy] and the progress of the patient's condition before and after. This information helps us to ensure our patient underwent safe procedures during their treatment.

As shown in Figure 5.5, during Process 4, the multidisciplinary expertise of doctors, nurses, pharmacist, dieticians and physiotherapists are involved to ensure a complete treatment and comprehensive evaluation are accurately delivered to chronic disease patients (Taylor et al. 2016). Thus, the competency in designing preventive care treatment plan is crucial for healthcare practitioners to manage preventive care treatment for chronic disease patients, monitor their improvement and obtain their confidence and trust in continuing to use hospital treatment. Despite ABC Hospital providing free or minimum cost preventive care services, still healthcare practitioners find it challenging to advise and convince patients to use conventional preventive care treatment that is scientifically proven rather than traditional medicine (Farooqui et al. 2011). This issue may be due to the lack of education concerning where to seek help, poor knowledge of symptoms, lack of awareness, fear and beliefs held on the causes of the disease, fear of side-effects from modern treatment (Dickens et al. 2014; Farooqui et al. 2011; Mahmud & Aljunid 2018) and health products that are

commercially available (Farooqui et al. 2011). A diabetic educator described how she applies the competency to convince patients to use hospital treatment:

Nurse In #12: Quite a number of my patients didn't take modern medicine but they prefer to follow traditional beliefs, such as to use leaves from plants to eat and take the leaf extract and make it into a drink. Nowadays, herbal drinks and traditional pills can be easily bought from beauty salons, online or a booth in the supermarket. This situation is very challenging for me as an educator, especially when we as healthcare practitioners want to instil patient's trust towards modern treatment that is scientifically proven to treat chronic diseases like diabetes. Although I can't force my patient to follow my advice in getting hospital treatment, I always provide advice and show them some pictures on the effect of traditional medicine on the kidneys for example, because not all people can tolerate the same thing.

Despite the challenging issue of traditional beliefs, healthcare practitioners are able to apply the competency in designing a preventive care treatment plan that is scientifically proven for chronic diseases. The following is one of the examples of how a doctor provides treatment for a patient with colorectal cancer who may need to undergo surgery:

Dr M #21: We have to see where a tumour or the cancer is. If there is not much complication, the specific area is cut and the normal area will be joined back again. But for certain emergency cases, such as perforated diverticulitis where the colon is leaking or the area is badly festered, the specialist can't join the colon back because the pouches become inflamed or infected. The inflammation can cause leaking. Therefore, we will do a temporary stoma to the patient to enable the patient to pass body waste.

Also, in Process 4, doctors apply the competency in designing a preventive care treatment plan as shown in Figure 5.5, to assist the patient to obtain additional treatment services. If the patient needs special services, doctors will refer patient cases to another relevant unit to strengthen the treatment delivered, such as referring to the dietetic unit, pharmacy or physiotherapy unit. Additionally, depending on the patient's chronic disease, such as diabetes and heart problems, they are referred to diabetes and quit-smoking clinics for counselling sessions, and to the health-education class. Additionally, involving the patient's family members during quit-smoking counselling sessions may promote awareness, and understanding about the importance of being healthy, managing the symptoms from quitting smoking and supporting the patient throughout the treatment process. This is consistent with a

previous study showing that emphasising that smoking is a major cause of heart disease and discussing smoking cessation treatment with the patient's family may help persuade them to promote positive behaviours (Abu-Baker, Haddad & Mayyas 2010). One nurse commented on a patient with a cardiovascular problem. The patient was referred to the quit-smoking clinic to be treated for smoking cessation.

Nurse K #38: Mostly, we will receive cases that are referred by the doctors such as patients with cardiovascular problems, high blood pressure and diabetes. For example, the patient has got a cardio problem and at the same time he has a smoking habit. In this case, my role is to assist the doctor in patient treatment by providing counselling sessions regarding smoking cessation to reduce the patient's cardiovascular problem. My approach is to educate my patient on how a smoking habit can cause a heart attack. The central part is to inform them of how the patient's heart will be affected if they continue smoking and don't want to quit. The purpose of educating the patient is to provide awareness and understanding on the smoking risks on heart illness.

Apart from that, the competency in designing a preventive care treatment plan (as shown in Figure 5.5) is also applied by healthcare practitioners to monitor the patient's health progress during Process 4, such as by monitoring medication consumption and to ensure the treatment provided is suitable for the patient.

Phar Sf #23: We have another service, we call it medication therapy adherence clinic. The purpose is to monitor whether the patient's medication consumption/intake schedule is right and whether the method the patient consumes it is also right. For example, the doctor will refer that this patient has to take medication for a blood thinner. We have to monitor this patient closely. We will interpret the blood reading. This patient cannot eat vegetables that have too much vitamin K, if not the medication might be ineffective. The purpose of the medication is to prevent blood clotting. This is to prevent stroke or hypertension. Therefore, we need to monitor the patient's diet too. We monitor the patient at the clinic patient, and from the result received, we will interpret the medication and blood result.

During Process 4, the competency skills development and teambuilding among healthcare practitioners (as shown in Figure 5.5) refers to the strength of the healthcare practitioners to communicate effectively, convince colleagues and patients, share knowledge and develop healthcare practitioners' knowledge and service delivery. Skills development and teambuilding have always been essential elements for successful organisations as well as hospitals. With the chronic disease burden

approaching developing countries including Malaysia, it is now more critical than ever that employees can be proactive and prepare themselves with skills and knowledge about these diseases.

This competency enables healthcare practitioners from different levels and departments to communicate, so that different perspectives and plans can be integrated into treatment and patient care (Curtis, Tzannes & Rudge 2011). Thus, problems can be identified and solved in a regular and sustained manner, resulting in efficient care and treatment delivered. For instance, one doctor commented on how this competency is applied to their teambuilding development.

Dr H #22: In certain cases, the patient will be immediately referred to the 'peri team' for further assessment and treatment. Peri team is a specialised team that will attend to critical patient cases that have more than one health problem. Peri team includes medical officers and a specialist. We learn a lot of things from this team because the members have special skills and experience. The leader will decide and provide us with a treatment plan. From the plan, we learn the treatment procedures and how to carry out the plan provided by this team.

Additionally, the competency in skills development and teambuilding among healthcare practitioners as shown in Figure 5.5, is applied to facilitate effective communication among healthcare practitioners on how to address patient health issues. This can be achieved by following the right procedures, and may result in reducing errors and delivering safe care to patients. A senior nurse commented on how the competency enables increased skills.

Nurse Sf #17: Sometimes, a patient might not understand why they need to consume or take specific medication. This is because they overthink about their disease and their pain. As nurses, we understand their situation, we can't force them to take the medication but as someone that knows the importance of taking the medication, I will persuade them. We must always follow the principles of 7R when it relates to administering medication to patients. They are right patient, right drug, right dose, right time, right route, right documentation and right of patient to refuse. Thus, this procedure provides guidance and enables us to improve our care delivery to the patient.

The competency in HIS proficiency as shown in Figure 5.5, refers to the ability of healthcare practitioners to use HIS to interpret the data produced and apply it for effective treatment decision-making by the patient (Barakat et al. 2013). During

Process 4, the competency in HIS proficiency was especially useful for healthcare practitioners, so they have timely information on the patient's health condition, diagnosis and treatment plan, and to translate the information for implementing the treatment plan. Competency in HIS proficiency is needed during Process 4 because this competency enables healthcare practitioners to keep themselves informed and prepared, disseminate relevant information, alert other healthcare practitioners on the patient's condition, and offer suggestions to pre-empt further action for patient treatment and improvement (Manias et al. 2014; Ozok et al. 2014). For example, one of the nurses described how healthcare practitioners apply this competency to ensure that they are well informed and prepared for carrying out patient treatment:

Nurse Sf #17: We received a new patient admitted to the ward late at night. This will not be a problem at all because after the doctor examined the patient, the patient's information and health history are recorded in the HIS and shared among healthcare practitioners. Through HIS, the particular patient's case is referred to the relevant department or unit. For example, the patient case is referred to the dietetic department for diet management. The HIS will alert the dietician about this new patient case, thus accelerate the dietician's tasks to invent a suitable diet for the patient and plan for a counselling session.

Further, a senior nurse commented on how applying the competency in HIS proficiency enables her to integrate information by using HIS to generate a comprehensive report that is crucial for the next shift. With this report, healthcare practitioners are able to provide continuous care in the next shift and alert other healthcare practitioners about any patient cases that need special attention.

Nurse Mr #18: We have to produce a 'passed report' so that information on treatment and related procedures are disseminated to our colleagues from the morning shift to the next evening and continue to night shift. We record all the things that happened in the HIS and the system will produce the report for every shift. The nurse will know what happened to the patient before this, continue to provide care for the patient and act according to patient cases.

In addition, this competency allows healthcare practitioners to use HIS to report on any patient incidents so that further action can be performed.

Dietician: Usually, we will report in the system on any unexpected situation, such as if a patient refuses to follow the diet plan. This will help us to inform the doctors and nurses about what the patient

situation is so that any further steps could be taken to help improve our patient's health.

In summary, enriching the combination of IS competencies 1) *competency in patient medical information management* 2) *competency in designing preventive care treatment plan* 3) *competency in skills development and teambuilding* and 4) *competency in HIS proficiency* during Process 4 contributes to the development of the capability in mapping patient health condition to the right type of preventive care.

5.5.3 Information system competency bundling: Accumulating and stabilising resources to develop competencies

As shown in Figure 5.5, in Process 4: patient treatment and monitoring, the IS competencies 1) *competency in patient medical information management* 2) *competency in designing preventive care treatment plan* 3) *competency in skills development and teambuilding* and 4) *competency in HIS proficiency* are developed through IS competency bundling by accumulating and stabilising IS resources. *Accumulating* IS resources refers to a process of developing IS competencies internally (Sirmon et al. 2011). *Stabilising* refers to a process of making minor incremental improvements to IS resources to develop IS competencies (Sirmon et al. 2011). The following elaborates how each of the IS competencies is accumulated and stabilised from IS resources.

The competency in patient medical information management is developed from tangible and intangible-IT resources. Tangible-IT resources are accumulated when the HIS system allows healthcare practitioners to use it for retrieving and matching patient medical history with current treatment procedures. Stabilising occurs when HIS provides accessible quality data, allowing healthcare practitioners to systematically make better treatment decisions (Arabchadegani 2013) to improve preventive care.

Dr Z #19: With the system, I know how to decide on certain treatment procedures as it provides the function of tracing previous records even from year 2009, 2010. I can track and study my patient's history and related information to understand my patient's background, their previous medical records and current health issues, thus enabling better preventive care treatment decisions.

Moreover, this competency is also developed from intangible-IT resources. The intangible-IT resource is accumulated when healthcare practitioners are concerned about customer orientation. By having customer orientation, healthcare practitioners would be able to manage patient information in HIS that consists of not only healthcare practitioner, but also patient, perspectives. Stabilising occurs when healthcare practitioners perform their tasks by prioritising customer needs to enable patients to express their concerns about their health issues. This in turn enables healthcare practitioners to understand their patient's feelings, educate and provide advice to patients, and gather and update patient information in HIS for treatment, thus resulting in competency in patient medical information management. A doctor explained how he spends his time with a patient during a doctor-patient consultation:

Dr L #7: I would say having the system would lessen our time in going through a new patient who is already in our list. Because sometimes we are assigned to a patient from another department, but this patient is new to us. But with HIS, it could help us in a sense that it could lessen our time to go through a disease for a patient. Therefore, you have more time to talk, offer advice and moral support to your patient.

As shown in Figure 5.5, the competency in designing preventive care treatment plan was developed through tangible and intangible-IT resources. Tangible-IT resources are accumulated when HIS is designed for processing, retrieving and documenting patient data to improving preventive care treatment (Monsted 2018). Stabilising occurs when HIS allows healthcare practitioners to utilise the information generated from the system to analyse patient health conditions and provide safer preventive care treatment and efficient care delivery (Catwell & Sheikh 2009).

Nurse Sf #17: I used the HIS for patient's data entry during treatment and monitoring. Sometimes, in certain situations, we have to change the patient's diet because of their health state, but if changing diet still cannot work then the doctor will provide other treatment alternatives, such as prescribing certain medicine. All this information will be recorded and reported in the system, such as the type of medicine that is served to the patient, the quantity, the action we write as 'medication A is served' and patient's reaction towards the treatment. By having complete treatment records in HIS, I would be able to monitor the patient's compliance to their treatment.

In addition, this competency is developed from intangible-IT resources. Intangible-IT resources are accumulated when ABC assigns a specialised team consisting of a consultant, a specialist, a doctor and nurses to other district hospitals to exchange

knowledge externally (Chung & Yoon 2015). By assigning a specialised team to share knowledge and deliver care at another district hospital, stabilising occurs when healthcare practitioners are able to practice existing and new knowledge to enhance treatment skills for preventive care at ABC. One of the consultants explained assigning a specialised team to exchange knowledge at another district hospital (sister hospital):

Dr St #39: Our specialist and doctors went to the sister hospital to attend patient cases. We bring our doctors and nurses too. Other than sharing knowledge and experience, our staff also have the opportunity to learn, practice and strengthen their treatment skills in a different environment with other hospital staff.

The competency in skills development and teambuilding among healthcare practitioners (as shown in Figure 5.5) is developed from human and intangible-IT resources. ABC supports its healthcare practitioners to practice skills by accumulating human-IT resources through a mentor-mentee program (Zhang et al. 2016) for skills development. The case analysis found that ABC has established a culture where the value of teaching and learning in practice is recognised and fostered by the team leader or senior to the team member (Henderson & Eaton 2013) through the mentor-mentee program.

A mentor-mentee program is established among junior (mentee), and senior (mentor) staff to build connections, initiate learning and enhance skills development among senior and junior staff. Stabilising occurs when the mentor-mentee program provides a platform that encourages the mentor to share knowledge and strengthen the mentor's interpersonal relationship skills, thus improving preventive care service delivery. According to the senior nurse:

Senior Nurse R #16: Everyone here is very committed to their work. We work together. We have mentor-mentee program for new staff in which we will teach and show them how to do the right thing.

In addition, the mentoring program in ABC is stabilised when the junior healthcare practitioners (mentees) are able to have exposure to the care processes to hone their medical skills and knowledge, and rectify their actions performed with the supervision of a senior healthcare practitioner, thus improving their scope of work. The following is the response from the doctor from the surgical clinic.

Dr N #9: Skills are based on experience. We keep doing it and our skill will develop. Another thing is, the specialist is very firm. When the specialist advises or gives comments about my work, I accept any of these because I know that this is for my own good. I take it positively and I must learn how to improve my skills and knowledge to deliver better and safer care to my patients.

Thus, the practice and supervision of seniors in the mentor-mentee program support juniors to gain new knowledge and enhance their skills.

Intangible-IT resources are accumulated when healthcare practitioners are able to establish good rapport (refer to Figure 5.5), thus promoting teambuilding. For example, the excellent rapport that exists between ABC's pharmacist and doctor promotes collaboration that may help achieve a better quality of preventive care. Rapport is defined as a 'high state of connectivity when two or more people communicate. They consciously or unconsciously share the same wavelength. This creates a climate of trust and understanding that facilitates receptivity of information (and therefore influence)' (Parker & Perez 2015, p. 20). In the context of ABC Hospital, stabilising occurs when healthcare practitioners understand and appreciate each other's opinion and are able to communicate well, thus enabling them to work together to deliver efficient preventive care treatment to patients. Consistent with previous studies, these case findings suggest that rapport exists in a collaboration among healthcare practitioners in different positions that may foster communication and result in coordination of care (Makowsky et al. 2013; Suter et al. 2009). For instance, the dietician described rapport and how it supports communication among the healthcare practitioners, thus helping in decision-making for preventive care delivery.

Dietician: Communication is crucial to us dieticians and doctors. Our role is important to support the doctors in making decisions primarily on a patient's diet. The doctors always involve us in the discussion for patient treatment. We need each other's opinion because we want to deliver safer care to the patient. If let's say the diabetic patient was given a wrong diet intake, the patient may get diarrhoea. Before we decide, we must convince the doctors that patient has to take particular diet that is appropriate for the health problem.

The case analysis also shows that in ABC, rapport is more than communicating between the healthcare practitioners, and includes respect for, and acknowledgement of, each other (Parker & Perez 2015). This case analysis found that in ABC, rapport is also stabilised when the pharmacists are able to perform dynamic roles in delivering

preventive care. Thus, the diversified knowledge of pharmacists accumulated from their dynamic roles enables them to provide reliable information and recommendations to the doctors (Makowsky et al. 2013) and contribute to the development of competencies in skills development and teambuilding. The pharmacist explained her good rapport with the doctors.

Pharma D #25: Doctors will diagnose and order medication. There are times when the doctors would like to clarify what is the best alternative for a patient in terms of medication. In this kind of situation, the doctors will seek our professional advice on what are the medicine's side-effects. Whether this medication can cause harm to that patient? So, this is when the pharmacist will come in and give advice to the doctors. What I mean, is that hand-in-hand we have this chemistry or good rapport. Sometimes we can see the team members physically but at one other's side, at times the relationship among us just exists in its own way, you didn't notice it.

As shown in Figure 5.5, the competency in HIS proficiency is developed from tangible and human-IT resources. Tangible-IT resources are accumulated when HIS is designed to produce standardised treatment procedures to be used by the healthcare practitioners for patient treatment. The system is stabilised when it can be set up to generate progress reports for patient monitoring, thus enabling immediate detection of risks on the patient's current condition. As a result, healthcare practitioners able to optimise the use of HIS and become alert to patient conditions, allowing for safer and quality preventive care treatment (Seblega et al. 2015).

Dr Z #19: The system helps me to organise my patient's data and also record treatment procedures systematically. I will not miss any data because the system has provided a specific column for me to key in examination data. For example, I will have to key in data about whether the patient has any allergies or any complication. This information is crucial because it may affect the patient's body reaction on certain treatments, thus the system helps to alarm us on this important aspect to prevent any patient mistreatment.

Moreover, ABC accumulates its human-IT resources by encouraging the healthcare practitioners to participate in the hospital's IT competition. ABC stabilises this resource by promoting a positive IT culture to its healthcare practitioners, thus enabling them to be proficient in HIS.

Pharma Sh #24: In our department, I exposed my staff to IT because we work in an IT hospital and we must utilise the technology to

expedite our work. I encourage my staff to join the hospital's IT competition. We called it the 'Kumpulan Inovatif dan Kreatif' project. We established a team and every year we come up with a project to develop simple software for our department to use. For example, in 2013, our team won the first place in the competition at the national level with the project Clicky MedDe, an audio software for patient counselling. It covers device techniques such as pen, insulin and pump.

In summary, accumulating and stabilising tangible-IT resources (such as the ability of HIS to provide information to assist healthcare practitioners to make decision, to utilise the information generated from the system to provide safer preventive care treatment and the HIS function that provides standardised treatment procedures to assist healthcare practitioners in delivering preventive care treatment), human-IT resources (such as participating in mentor-mentee programs and IT competitions) and intangible-IT resources (such as customer orientation and synergy) during Process 4 contributes to the development of 1) *competency in patient medical information management* 2) *competency in designing preventive care treatment plan* 3) *competency in skills development and teambuilding* and 4) *competency in HIS proficiency*.

5.6 Developing capability in mapping patient health condition to the right type of preventive care in Process 5

As described in the previous section, capability in mapping patient health condition to the right type of preventive care is developed from a combination of IS competencies in three preventive care patient processes. This section continues to explain how this capability is developed in Process 5: patient evaluation after treatment and monitoring.

Figure 5.6 shows the development of IS capability: *capability in mapping patient health condition to the right type of preventive care* in Process 5. The findings shown in Figure 5.6 start with how IS capabilities leverage preventive care performance (box with yellow colour), followed by how the IS capabilities are made up through IS capability bundling (box with green colour) and how the case identifies IS resources to develop specific IS competencies through IS competency bundling (box with red and green shaded colour). Figure 5.6 is explained in Sections 5.6.1 to 5.6.3, with each section showing a piece of the figure.

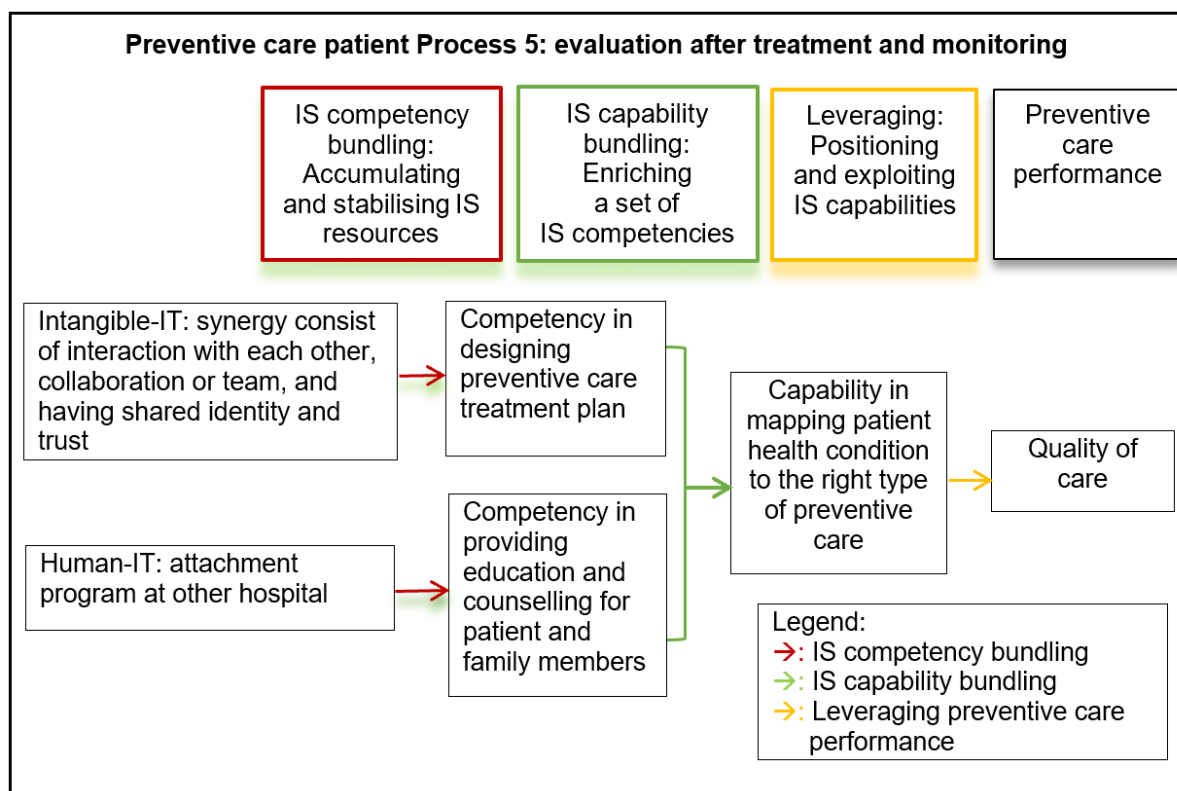


Figure 5.6: Developing capability in mapping patient health condition to the right type of preventive care in Process 5

Note: IS = information system; IT = information technology

5.6.1 Leveraging information system capability for preventive care in Process 5

As shown in Figure 5.6, during Process 5: patient evaluation after treatment and monitoring, ABC leverages its IS capability: *capability in mapping patient health condition to the right type of preventive care* through positioning and exploiting the IS capability to achieve quality of care. *Positioning* refers to how a hospital matches and leverages its internal IS capabilities with the preventive care patient process to achieve preventive care performance (Chatzkel 2002). *Exploiting* refers to using, developing (Levinthal & March 1993), refining and extending existing IS competencies (March 1991) within the hospital's limited resources to positively and accurately improve each preventive case patient process to achieve efficient and effective preventive care performance.

This section explains Process 5 and how the IS capability is leveraged to achieve one of the preventive care performance indicators – quality of care.

During Process 5, it is vital that the impact from treatment and monitoring is assessed by healthcare practitioners for patient health development. This is because the objective of this process is to compare patient wellbeing after undergoing treatment and evaluate health outcomes if further treatment improvement is needed.

For example, to achieve quality of care, ABC Hospital positions its IS capability: *capability in mapping patient health condition to the right type of preventive care* with Process 5 (refer to Figure 5.6). ABC is thus able to exploit this capability to evaluate patient progress after treatment and provide additional assistance so patients have easy access to further treatment, which may result in quality of care (Samb et al. 2010).

Dietician: First we need to evaluate why a patient does not take much food or the diet that we planned for them. For example, a diabetic patient must be given a diabetic diet. Usually, the patient will find that the food might be tasteless compared to food from home, but as a dietician, I must encourage the patient to take the planned diet to recover. After some time, I can see the patient's appetite has improved. During that time, I will talk and counsel the patient and their family members who are taking care of that patient about how to manage and control the patient's food intake and its impact in reducing diabetic complications. For example, I will encourage the patient to follow the food pyramids so that they will have the right portion for foods, and also I emphasise sugar intake in foods and drinks. With support from family members, my patients are able to understand that our intention is to help them to control and reduce diabetic complications.

In summary, leveraging the IS capability: *capability in mapping patient health condition to the right type of preventive care* through positioning and exploiting the IS capability in Process 5: patient evaluation after treatment and monitoring, helps to achieve one of the preventive care performance indicators – quality of care. The following sections elaborate on how this IS capability is developed from IS capability and competency bundling.

5.6.2 Information system capability bundling: Enriching a combination of competencies to develop capabilities

As shown in Figure 5.6, in Process 5: evaluation after treatment and monitoring, the IS capability: *capability in mapping patient health condition to the right type of preventive care* is developed through capability bundling by enriching a combination

of IS competencies. *Enriching* refers to the process of extending current IS capabilities (Sirmon, Hitt & Ireland 2007) through a collective of IS competencies. The IS competencies involved are 1) *competency in designing preventive care treatment plan* and 2) *competency in providing education and counselling for patient and family members*. The following elaborates the IS competencies that were enriched to develop the IS capability.

In Process 5, healthcare practitioners apply competency in designing preventive care treatment plan to provide the patient with an evaluation after treatment and explain further treatment needed to address the side-effects from previous treatment. For example, based on doctor evaluation and nurse observations, the patient is referred to the relevant unit to have further treatment. The physiotherapist applied the competency in designing a preventive care treatment plan to explain a further treatment plan that she will provide to one of her cancer patients:

Physio F #5: The patient experienced swelling in their arm or leg that was caused by breast or cervical cancer. It is something to do with fluid retention and tissue swelling caused by a blocked lymphatic system. When tissue is removed from the breast, then it will cause a problem for lymphatic drainage as the fluid has nowhere to go. After some time, the accumulated liquid can cause swelling to the arm or leg. We will do massage fatigue drainage to help the fluid flow to the functioning lymphatic system. Then we will bandage the arm or leg properly. In this case, it is important to explain to the patient what is happening and how we will treat the patient.

In Process 5, healthcare practitioners apply the competency in providing education and counselling for patient and family members (as shown in Figure 5.6) to provide support to family members and motivate patients to improve their physiological and psychological health (Engebretson, Matrisian & Thompson 2015; Jacobsen & Andrykowski 2015). For example, one of the physiotherapists described how she applies this competency to address mood disorders in a cancer patient:

Physio F #5: Usually my cancer patients will experience psychological distress and a low level of confidence. Not many of them can accept what is happening to them. Therefore, we emphasise the psychological element which focuses on the patient's mind and emotion before we continue with physiotherapy. Emphasising the patient's psychology is important before we proceed with specific treatment because with support, our patient may be able to understand her current health state, be prepared for what is going to happen next,

thus I will encourage patients to be strong to go through the procedures. We explain thoroughly about the treatment plan that we will deliver because the treatment will take time and we also share with the patient about her current health condition, the treatment plan, the purpose of the treatment and the possible outcome.

In summary, enriching a combination of IS competencies 1) *competency in designing preventive care treatment plan* and 2) *competency in providing education and counselling for patient and family members* contributes to the development of the capability in mapping patient health condition to the right type of preventive care.

5.6.3 Information system competency bundling: Accumulating and stabilising resources to develop competencies

As shown in Figure 5.6, in Process 5: patient evaluation after treatment and monitoring process, the IS competencies 1) *competency in designing preventive care treatment plan* and 2) *competency in providing education and counselling for patient and family members* are developed through IS competency bundling by accumulating and stabilising IS resources. *Accumulating* IS resources refers to a process of developing IS competencies internally (Sirmon et al. 2011). *Stabilising* refers to a process of making minor incremental improvements to IS resources to develop IS competencies (Sirmon et al. 2011). The following elaborates how each IS competency is accumulated and stabilised from IS resources.

The competency in designing preventive care treatment plan is developed from intangible-IT resources. Intangible-IT resources involve synergy. Synergy refers to outcomes that are only possible by working with others (Corwin, Corbin & Mittelmark 2012), with trust, sharing the same identity and having respect for each other (Chung & Yoon 2015). Synergy is accumulated when there is social interaction between two or more individuals, in a team and between departments where resources, knowledge and information sharing take place (Raine et al. 2014). Synergy promotes an excellent team climate, which contributes to better team performance, thus helping ABC healthcare practitioners deliver efficient preventive care treatment (Raine et al. 2014). According to a doctor from the surgical unit, he cooperates with his seniors to clarify treatment design for a cancer patient.

Dr M #21: We do cooperate, we need each other. We try to do our best but at certain times we need to discuss with the senior medical officers to come out with the best treatment for our patient.

Synergy is stabilised when ABC's healthcare practitioners perform tasks together in which their differences in job position do not matter, because although they are in competing positions, they are completing and improving each other's roles to provide care to patients (Weller, Barrow & Gasquoine 2011). For example, in ABC, the synergy happens between the different roles of nurses and doctors. The nurses alert doctors about the patient's progress and will inform them of the patient's observation results. In turn, the doctors will evaluate the patient's condition and design further treatment procedures. The mutual trust and respect between nurses and doctors mean that they value their respective contributions towards patient care (Weller, Barrow & Gasquoine 2011), which results in excellent preventive care treatment design. Thus, synergy could contribute to the development of the competency in designing preventive care treatment plan. A nurse described how she acts as a middle person between the doctor and patient to handle the patient's needs and communicate their progress to the doctor for a further treatment plan:

Nurse Sf #17: We have great tasks and are very close to our patients. We are like the middle person between a doctor and the patients. Most of the time, patients are comfortable to tell us about their physical condition and their feelings. As a middle person, the doctor trusts our ability to be closer to the patient and observe the patient's condition. In turn, we will communicate the patients' needs and problems to the doctors for further action.

As shown in Figure 5.6, the competency in providing education and counselling for patients is developed from human-IT resources. Human-IT resources are accumulated when the healthcare practitioners are involved in attachment at other hospital that requires them to practise, learn new skills and gain experiences when dealing with different chronic diseases at other hospitals. Stabilising occurs when there is an increased understanding in preventive care of chronic disease areas that could help healthcare practitioners improve management of patients' physiological and psychological care, thus resulting in competency in providing education and counselling for patient and family members. One of the senior physiotherapists explained that she learns special skills and gains new knowledge during her attachment at another hospital, giving her an in-depth understanding in her field.

Usually, she receives cases involving patients with breast cancer who have lymphedema problems that result in swelling in a single arm or both limbs after surgery.

Physio F #5: I learn a lot from others. But to gain experience, increase skills and obtain new knowledge on special massage techniques, I do an attachment at another hospital. The attachment provides me with advanced knowledge, in-depth understanding and skills in lymphedema training to become certified in lymphedema management thus help me to educate and address patient's emotional and physical wellbeing.

In summary, accumulating and stabilising human-IT resources (such as participating in attachment program at other hospital) and intangible-IT resource (such as synergy) during Process 5 contributes to the development of 1) *competency in designing preventive care treatment plan* and 2) *competency in providing education and counselling for patient and family members*.

Sections 5.4–5.6 discussed Processes 3–5, which involve providing alternatives on suitable treatment, carrying out the treatment plan, monitoring patients and assessing the treatment performed for patients with chronic diseases. The case findings show five IS competencies were applied in these three processes that result in the development of capability in mapping patient health condition to the right type of preventive care.

5.7 Developing capability in sustaining patient health condition in Process 6

Figure 5.7 shows the development of IS capability: *capability in sustaining patient health condition* in Process 6: patient maintenance that is developed through IS competency and capability bundling to achieve preventive care performance. The findings shown in Figure 5.7 start with how IS capabilities leverage preventive care performance (box with yellow colour), followed by how the IS capabilities are made up through IS capability bundling (box with green colour) and how the case identifies IS resources to develop specific IS competencies through IS competency bundling (box with red and green shaded colour). Figure 5.7 is explained in Sections 5.7.1 to 5.7.3, with each section showing a piece of the figure.

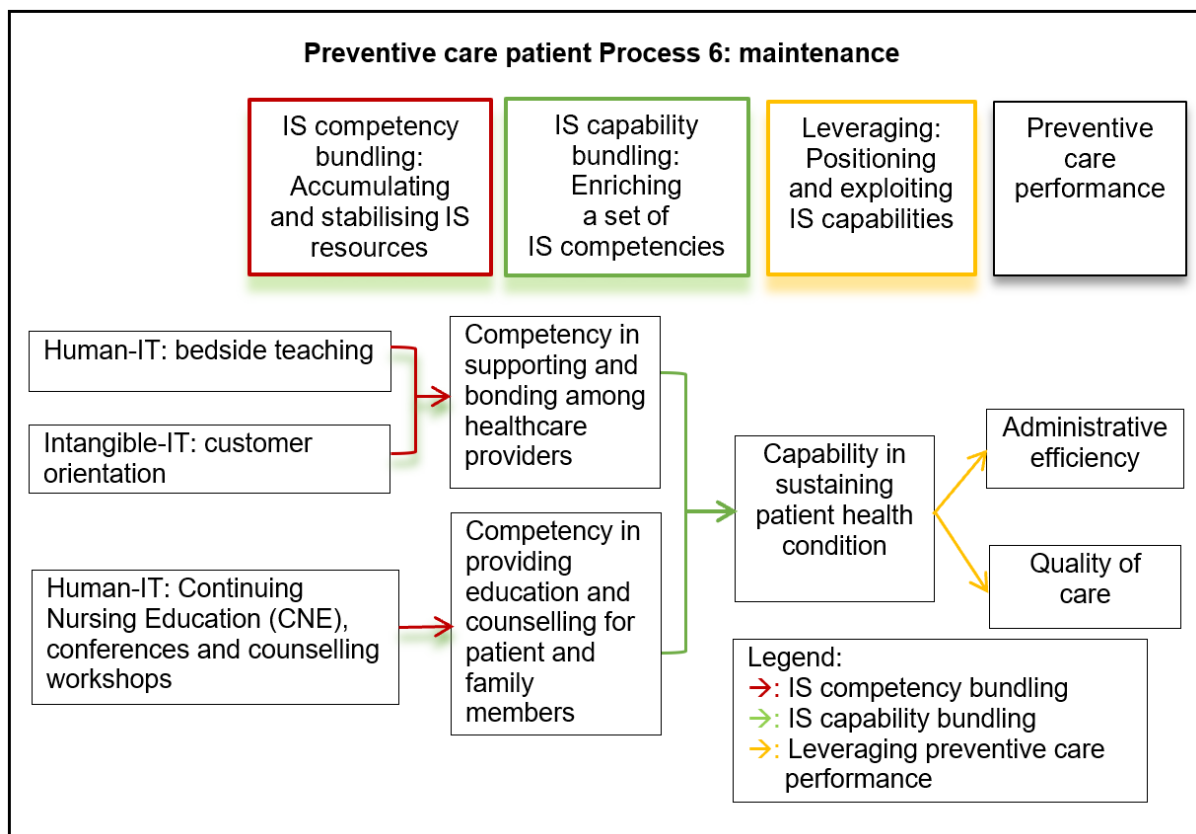


Figure 5.7: Developing capability in sustaining patient health condition

Note: IS = information system; IT = information technology

5.7.1 Leveraging information system capability for preventive care in Process 6

As shown in Figure 5.7, during Process 6: patient maintenance, ABC leverages its IS capability: *capability in sustaining patient health condition* through positioning and exploiting the capability to achieve administrative efficiency and quality of care. *Positioning* refers to how a hospital matches and leverages its internal IS capabilities with the preventive care patient process to achieve preventive care performance (Chatzkel 2002). *Exploiting* refers to using, developing (Levinthal & March 1993), refining and extending existing IS competencies (March 1991) within the hospital's limited resources to positively and accurately improve each preventive case patient process to achieve efficient and effective preventive care performance.

This section explains Process 6 and how the associated IS capability is leveraged to achieve two of the preventive care performance indicators – administrative efficiency and quality of care.

The objective of this process is to provide the patient with support and encouragement to continue treatment after they are discharged from ABC Hospital. As chronic diseases are long term, sufficient and understandable information to control the disease once patients are home is crucial (Choudhry et al. 2016). Providing the patient with adequate information may assist them to prepare for discharge and adequately manage their care at home, thus reducing the likelihood of unnecessary hospital readmissions (Hesselink et al. 2012). How to deliver understandable information and instructions to encourage the patient to maintain their health raises a significant challenge to ABC and other healthcare organisations (Stenner, Courtenay & Carey 2011). To cope with the challenge, *capability in sustaining patient health condition* is essential because it enables healthcare practitioners to build a patient-practitioner relationship to create an interaction and make communication easier (Barrett & Puryear 2006). This can be achieved when healthcare practitioners are able to educate and provide counselling to patients using simple language, thus assisting them to understand medical information and post-discharge instructions correctly, and ensuring they can access the care plans and manage care at home (Barrett & Puryear 2006).

For example, to achieve administrative efficiency and quality of care, ABC Hospital positioned its IS capability: *capability in sustaining patient health condition* with Process 6 (refer to Figure 5.7). By doing so, the hospital exploited this capability to improve patient understanding on their health and treatment information, thus avoiding patient confusion and frustration, and resulting in administrative efficiency and high quality of care (Barrett & Puryear 2006). A senior doctor described ABC's ability to sustain patient health condition by providing understandable medical information.

Dr St #39: If the patient is not satisfied, the patient will do doctor shopping. Patients will switch to many different hospitals if they are not satisfied with the services provided. What the patient needs is sufficient and understandable information from the doctors. If patients understand the reasons for continuing with the treatment at home, the patient will adhere and continue maintaining their health at home. At ABC, I can say that most of my patients give positive feedback. It is how we explain and educate our patients about the importance to continue maintaining their health at home.

Furthermore, to achieve quality of care, ABC exploits the *capability in sustaining patient health conditions* (refer to Figure 5.7), to increase patient empowerment and

motivation to make behaviour changes (Barrett & Puryear 2006). With support from healthcare practitioners, it is more likely that the patient will be committed and able to continue self-care treatment at home, including visiting the hospital for follow-up care, which represents of care. The counsellor from the quit-smoking clinic explained his experience in dealing with a cardiovascular patient with a smoking habit:

Nurse K #38: Since I've been working at this clinic patients greatly valued this service. Recently, this clinic achieved the performance indicator with around 98% of patients attending our treatment and follow-up counselling session. Most of my patients are able to change their smoking habits after receiving our advice and treatment. This is because we emphasise providing awareness and educating the patient on smoking risks and its impact on the patients and the people that they love. By motivating patients, we are able to help patients to gain confidence to use the treatment and visit us for follow-up care.

In summary, leveraging the IS capability: *capability in sustaining patient health condition* through positioning and exploiting the capability in Process 6: patient maintenance, helps to achieve two of the preventive care performance indicators – administrative efficiency and quality of care. The following sections elaborate on how this IS capability is developed from IS capability and competency bundling.

5.7.2 Information system capability bundling: Enriching a combination of competencies to develop capabilities

As shown in Figure 5.7, in Process 6: patient maintenance, the IS capability: *capability in sustaining patient health condition* is developed through IS capability bundling by enriching a combination of IS competencies. *Enriching* refers to a process of extending current IS capabilities (Sirmon, Hitt & Ireland 2007) through a collective of IS competencies. The IS competencies involved are 1) *competency in supporting and bonding among healthcare practitioners* and 2) *competency in providing education and counselling for patient and family members*. The following elaborates each of the IS competencies that were enriched to develop the IS capability.

In Process 6, healthcare practitioners apply the competency in supporting and bonding among healthcare practitioners (as shown in Figure 5.7) to encourage commitment from healthcare practitioners to work flexibly and actively to deliver preventive care to patients. Hence, healthcare practitioner commitment towards offering better care

enables them to meet patient care needs, especially on post-treatment. For example, one of the consultants described how his subordinates cooperate among themselves to ensure the patient receives the treatment correctly.

Dr S #39: There are certain times patients couldn't come for follow-up to the clinic on the appointment date because of some reason. This can cause a problem to us because there are patients that are on waiting lists. We can't move existing patient appointments at any later date but we are able to work flexibly. Therefore, we provide an option to a patient with this special case. Patients that really cannot meet the date can come to the ward because our ward is open every day. Our doctors and nurses are very flexible, they consider certain situations as special individual cases. This is how we want to encourage our patients to come for follow-up by offering some flexible time.

Other than offering flexible times for the patient to visit ABC Hospital for follow-up, ABC also sends a number of its selected healthcare practitioners to deliver care at another district hospital called a sister hospital. This provides easy access to care for patients who live far from ABC Hospital, thus contributing to the quality of care.

Dr St #39: Instead of the district hospital referring cases to ABC, we went to this hospital to meet the patients. We call this hospital our sister hospital. We have our own clinic at this sister hospital. We are able to develop networking with its healthcare practitioners by involving our doctors and nurses to visit the hospital to share skills and knowledge. This kind of effort gives a lot of benefit to our healthcare practitioners and of course the patients. The patient does not have to travel such a long way to come here to meet the specialist. The district hospital will schedule serious patient cases and follow-up for our specialist to examine at the district hospital.

As shown in Figure 5.7, the competency in providing education and counselling for patient and family members refers to the capacity of healthcare practitioners to provide awareness, understanding and guidance about patient diseases, medication and devices, and encouraging carers to be involved in patient care. Given the importance of knowledge and understanding of chronic diseases, risk factors and care management, healthcare practitioners apply this competency to provide education and counselling for patients and family members to increase awareness and understanding about the danger of the disease, knowledge about preventing the disease and management in reducing complications.

This competency aids healthcare practitioners in promoting positive patient attitudes and disciplines in encouraging patients to practice care at home, thus maintaining the patient's health condition and helping to avoid any recurrence of disease. This is because there is the possibility a patient will choose not to take medication and stop doing their physical exercises because they are no longer under the supervision of the doctors and nurses. Beliefs, myths about side-effects (Dickens et al. 2014; Risso-Gill et al. 2015), daily routine, non-availability of tablets, non-awareness about taking it for life and boredom are barriers to adherence to medication and treatment (George et al. 2016). The dietician explained how she applies the competency in providing education and counselling for patients:

Dietician: Before the patient is discharged, I will ensure that I deliver counselling to the patient and to his family members because this may help the whole family to be aware of the chronic disease, its risks and implications and how to control the disease from getting worse. This kind of chronic disease mostly runs in the family. Usually, I find that my patient that suffers from hypertension will also relate to his parent. Therefore, we want them to be aware of this disease in the beginning. We advise patients on food intake, the importance of consuming the right medication and the implications of not taking the correct medication and the importance of doing physical activities when they are at home.

Moreover, healthcare practitioners apply this competency to encourage patients' family members to get involved in patient care. This is because positive support from family members not only affects a patient's chronic disease survival (Black et al. 2016; Gallant 2003; Kruithof et al. 2013; Norris & Gregg 2000; Rosland et al. 2010) but in some instances also helps to prevent recurrence of the chronic disease in an existing patient and also avoids the risk of developing the disease in family members. In stroke cases, patients are referred to the dietetic department where the dietician applies this competency to analyse patient condition and provide diet counselling and relevant techniques to assist the patient to eat and encourage family members to provide support to the patient.

Dietician: Usually we will counsel the patient and family members about the importance of understanding this disease, its symptoms and how to manage patients with stroke. With this information, family members are aware of the risk of having a stroke. Moreover, we also explain to them the reasons behind doing this treatment so that when they understand our treatment objectives and its outcomes, the family

members can give full support to the patient. We need to support our patient, encourage him to be independent to keep on doing things on his own. Although the patient cannot really go back to normal, at least he can be independent and take care of himself.

Other than offering patient and family members useful information, the right method and technique for medication intake, dietary and exercise therapy, healthcare practitioners also provide instructional booklets and pamphlets, for example, home-based exercises that may improve the patient's adherence to exercise therapy (Sacco & Sartor 2016) and also for patient empowerment (Kuijpers et al. 2013).

In summary, enriching a combination of IS competencies 1) *competency in supporting and bonding among healthcare practitioners* and 2) *competency in providing education and counselling for patient and family members* during Process 6 contributes to the development of the capability in mapping patient health condition to the right type of preventive care.

5.7.3 Information system competency bundling: Accumulating and stabilising resources to develop competencies

As shown in Figure 5.7, in Process 6: patient maintenance, the IS competencies 1) *competency in supporting and bonding among healthcare practitioners* and 2) *competency in providing education and counselling for patient and family members* are developed through IS competency bundling by accumulating and stabilising IS resources. *Accumulating* IS resources refers to a process of developing IS competencies internally (Sirmon et al. 2011). *Stabilising* refers to a process of making minor incremental improvements to IS resources to develop IS competencies (Sirmon et al. 2011). The following elaborates how each IS competency is accumulated and stabilised from IS resources.

The competency in supporting and bonding among healthcare practitioners (as shown in Figure 5.7) is developed from human and intangible-IT resources. Human-IT resources are accumulated when healthcare practitioners are involved in bedside teaching. Bedside teaching is medical education that is organised to benefit learners and patients (Gebrekirkos & Van Wyk 2016). Bedside teaching is stabilised when juniors are able to use their experience during the education program to increase their confidence level, communication skills, frequency of caring attitudes, and

consequently sustain long-term improvements in a patient, thus improving patient satisfaction (Burtson & Stichler 2010). In addition, seniors play a role as facilitators in explaining to patients the importance of bedside teaching; that is, to increase patient awareness on issues related to patient wellbeing (Gebrekirkos & Van Wyk 2016). Participating in bedside teaching helps to foster healthcare practitioners' internal motivation towards patient care and promotes social interaction opportunities among junior and senior healthcare practitioners, thus contributing to this competency development.

Nurse N #32: At the ward, senior nurses encourage junior nurses to practice their skills and knowledge by having bedside teaching. We will choose a topic and present it in front of patients, seniors and colleagues in this department and at another department too. This would expose us to new experiences to provide quality care to patients.

Furthermore, this competency is developed from intangible-IT resources (refer to Figure 5.7). Intangible-IT resources are accumulated through customer orientation. Customer orientation is defined as a set of beliefs with the customer's interest and satisfaction as a priority for an organisation (Hartline, Maxham & McKee 2000; Lanjananda & Patterson 2009; Ruekert 1992). Stabilising occurs when ABC promotes a customer service climate in the hospital with its services and practices, thus increasing healthcare practitioner's commitment towards providing excellent preventive care service to patients. Thus, the customer orientation resource could contribute to the development of the competency in supporting and bonding among healthcare practitioners. For instance, one of the consultants described ABC's client-friendly care to the patient:

Dr St #39: In ABC, our department emphasises client-friendly care. For example, some diabetic patients, when they are discharged from the ward, they find it difficult to visit ABC for follow-up. Therefore, in the beginning when the patient is admitted to the ward and has received treatment from us, our doctors and nurses have started to teach the family members to learn how to do dressings for the wound at home. ABC provides a complete dressing kit so that the person who takes care of the patient can do the routine at home. Another way, our staff also would visit the patient's house to find how they are doing and to provide care to the patient.

During Process 6, the competency in providing education and counselling for patients and family members (as shown in Figure 5.7) is developed by utilising human-IT

resources. This case analysis shows that human-IT resources are accumulated through continuing nurse education (CNE). CNE is a form of interactive learning experience for nurses that is stabilised when the nurses are able to increase their knowledge and skills in providing services for patients, and learn about new developing health areas and patient health issues (Ahmad et al. 2012). With a minimum of 20 continuous personal development points collected from participating in CNE, nurses can renew their Annual Practice Certificate from the Malaysian Nursing Board (Ahmad et al. 2012). The diabetic educator described the CNE learning program:

Nurse In #12: Continuing nursing education is a platform for nurses to be exposed to new issues, skills and related nurse education. This is where we learn about patient care, new procedures and techniques. Besides, every four to five years there will be a guideline or clinical practice that we need to learn precisely and update our knowledge on diabetic procedures and help us to improve our counselling approach.

Moreover, human-IT resources are accumulated when healthcare practitioners participate in conferences and counselling workshops (refer to Figure 5.7), to update their knowledge in their specialised field (Maimela et al. 2015) from experts from other states and also from other countries. Stabilising occurs when healthcare practitioners update existing knowledge and apply new knowledge obtained from these events to provide education and counselling to patients. The educator from the diabetic clinic commented on conferences and workshops.

Nurse In #12: Annually we participate in local and international conferences and workshops to know more about the development of diabetic disease and its treatment. By participating in these events, I have the opportunity to obtain new knowledge, especially on new techniques or medication that is being used for diabetic disease in developed countries. When I meet my patient, the knowledge that I gather would help my counselling.

In summary, accumulating and stabilising human-IT resources (such as bedside teaching, CNE, conferences and counselling workshops) and intangible-IT resource (such as customer orientation) during Process 6 contributes to the development of 1) *competency in supporting and bonding among healthcare practitioners* and 2) *competency in providing education and counselling for patient and family members.*

Table 5.3 presents a summary of the ABC Hospital case analysis.

Table 5.3: Summary of overall case analysis of ABC Hospital

		IS competency bundling (accumulating & stabilising)								Leveraging IS capabilities (positioning & exploiting)
		<div> ■ : Tangible-IT resources ■ : Human-IT resources ■ : Intangible-IT resources </div>								
IS capability bundling (enriching a combination of IS competencies to develop IS capabilities)	Process	IS capabilities:	IS competencies:							
			Manage patient info	Design treatment plan	Supporting and bonding	Skills development & teambuilding	HIS proficiency	Education & counselling	Preventive care performance	
	1	Registration	Managing patient profiling	Human-IT: IT short courses & learning from seniors		Human-IT: presenting patient cases				Administrative efficiency
	2	Investigation and diagnosis	Investigating & diagnosing patient health condition	Tangible-IT: error-free patient data Human-IT: post-basic course		Human-IT: spiritual attitude Intangible-IT: knowledge asset- exchange knowledge internally from specialists & consultants	Human-IT: positive attitude towards IT			Quality of care Administrative efficiency Quality of care Health promotion
	3	Evaluation after investigation and diagnosis		Tangible-IT: data integration for better patient treatment plan Human-IT: sharing knowledge with colleagues from different roles e.g. Pharmacy Info. Centre	Human-IT: attachment program in another department in ABC					Administrative efficiency
	4	Treatment and monitoring	Mapping patient health condition to the right type of preventive care	Tangible-IT: decision making Intangible-IT: customer orientation	Tangible-IT: patient data process, retrieval & documenting Intangible-IT: knowledge assets- exchange knowledge externally from consultants etc.	Human-IT: mentor-mentee program Intangible-IT: Synergy- good rapport	Tangible-IT: data treatment procedures Human-IT: IT competition			Quality of care Health promotion
	5	Evaluation after treatment and monitoring		Intangible-IT: Synergy-interaction with each other, shared identity & trust				Human-IT: attachment at other hospital		Quality of care
	6	Maintenance	Sustaining patient health condition		Human-IT: bedside teaching Intangible-IT: customer orientation			Human-IT: CNE program, conferences & workshops		Administrative efficiency Quality of care

To summarise this case analysis chapter, Table 5.3 presents a summary of the overall view of the findings, thus providing answers to the research question:

How does a hospital integrate information system resources that lead to information system competencies and information system capabilities in preventive care performance?

The research interpretation of the results in Table 5.3 suggests the following critical observations. The IS resources consist of tangible-IT (green font), human-IT (orange font) and intangible-IT resources (pink font) as the key elements of the IS competencies. Each column that is filled with the identified IS resources points to a specific IS competency that leads to specific IS capabilities in each preventive care patient process that is leveraged to preventive care performance, as shown in each row.

5.8 Conclusion

This chapter presented the main findings of this research, which suggest that the core processes that facilitate the development of six IS competencies and four IS capabilities for preventive care are formulated through two types of resource bundling processes: IS competency bundling, which consists of accumulating and stabilising IS resources to develop IS competencies; and IS capability bundling, consisting of enriching a combination of different IS competencies to develop IS capabilities. Finally, IS capabilities are leveraged through positioning and exploiting to meet the unique needs of preventive care. Overall, resources are what a healthcare organisation possesses, and are under the healthcare organisation's control (Amit & Schoemaker 1993); hence the uniqueness of each healthcare organisation lies in the way they bundle their resources, competencies and capabilities (Coates & McDermott 2002).

Chapter 6 discusses the implications and the outcomes of the research findings.

CHAPTER 6 – DISCUSSION

The literature review in Chapter 2 established the link between resources and preventive care performance through the bundling of IS competencies and IS capabilities. Chapter 4 outlined that ABC Hospital, a public hospital in a developing country, was selected for this single case study focused on preventive care services due to the success of its preventive care services and unique bundling of competencies and capabilities. Chapter 5 then established that ABC Hospital bundled its IS resources through IS competency bundling and capability bundling to achieve successful preventive care performance. Chapter 7 will show that hospitals in developing countries that are preparing for, or improving, their preventive care services will find the managerial contributions of this research helpful.

This chapter discusses the research undertaken for this thesis in five sections. Section 6.1 introduces the significance of the research, and how it was situated in the context of chronic disease preventive care; Section 6.2 explains the development of IS competencies through IS competency bundling; Section 6.3 discusses the development of IS capabilities through IS capability bundling; Section 6.4 highlights leveraging preventive care performance; and Section 6.5 concludes the chapter.

6.1 Significance of the research

To reiterate the research background, chronic diseases are the leading cause of death (Borowski et al. 2018; Stephani, Opoku & Quentin 2016) with an economic burden worldwide, thus posing a challenge not only to healthcare industries but also to the global community (Einarson et al. 2018; Liu et al. 2013). Chronic diseases need to be addressed by utilising preventive care services, especially in developing countries with limited health resources (George et al. 2018; Lee, Chiang & Liu 2018; Shah et al. 2018), rising death rates (Sagner et al. 2016) and rising healthcare costs (Deloitte 2018). To address those challenging issues, HIS is extensively used as an appropriate tool (Beck et al. 2018; Negash et al. 2018; Sayed et al. 2018; Zayyad & Toykan 2018). HIS aims to increase access to high-quality care by patients and improve healthcare practitioner workflow (Askar, Ardakani & Majdzade 2017) through effective preventive care. However, there has been little research on how hospitals effectively use HIS

(Alwan, Awoke & Tilahun 2015) to improve preventive care performance; rather research has primarily focused on challenges in integrating and utilising HIS with other IS resources (Askar, Ardakani & Majdzade 2017; Wahid et al. 2018). Given that hospitals have to address the escalating threats posed by chronic diseases against a background of scarce health resources (Rasekaba et al. 2018; WHO 2013), a hospital with IS competencies and capabilities can succeed in its preventive care performance because its healthcare practitioners can apply the necessary skills to address the unpredictable chronic disease epidemic and provide advanced and extended levels of care to patients (O'Connell, Gardner & Coyer 2014). Hence, it was valuable to research how a hospital integrates its limited IS resources to develop IS competencies and capabilities for preventive care performance.

Previous studies have investigated resources use for preventive care. However, they generally discuss the capacity of the resources (McElwaine et al. 2016; Van Minh et al. 2014; Yamey 2012) or focus on resource functions for preventive care (Adonis et al. 2016; Sacco & Sartor 2016; Selvarajah et al. 2013). Such studies focus, for example, on health facilities, technology and health workers (Van Minh et al. 2014) and the IT functions (Ahmad & Tsang 2013; Ayatollahi et al. 2018; Herrin et al. 2015) rather than the development of IS resources, competencies and capabilities in preventive care (Cardeal & António 2012; Peppard & Ward 2004). This research therefore investigated the integration and use of resources (Kangas 1999) of a public hospital by focusing not only on the hospital's IS resources and the development of IS competencies and capabilities, but also on the processes that it undertakes in integrating and utilising those resources to offer a better quality of preventive care for patients. It thus expands on research by Sirmon et al. (2011) and Sirmon et al. (2007) by introducing how IS resources are accumulated and stabilised into IS competencies and enriched into IS capabilities to leverage preventive care performance.

This research found performance is improved not only through bundling of IS resources, competencies and capabilities, but also how these resources are managed, bundled and leveraged (Sirmon et al. 2011) to create a better quality of preventive care performance. This current research unveiled how ABC structured its limited IS resources that comprise the human-IT resources of healthcare practitioner skills, knowledge, experiences and attitudes; the tangible-IT resources of HIS; and the

intangible-IT resources of customer orientation, synergy and knowledge assets to achieve the bundling of six IS competencies that enrich four IS capabilities for preventive care performance. To develop the four IS capabilities, ABC Hospital first needed to accumulate and stabilise its IS resources to develop IS competencies. Second, the hospital had to enrich its IS competencies to build IS capabilities. Finally, the hospital had to leverage its IS capabilities by positioning and exploiting them to achieve successful preventive care performance. The key terms of *accumulating*, *stabilising*, *enriching*, *positioning* and *exploiting* are elaborated later in this chapter. This scenario reflects that two types of bundling of resources were involved in the ABC Hospital case study, rather than one as highlighted by the literature review (Sirmon et al. 2011). Thus, IS competency bundling and IS capability bundling reveals the answer to 'something happens' between resources and performance from a resource orchestration perspective (Davis-Sramek, Germain & Krotov 2015, p. 1407).

6.2 Information system competency bundling through accumulating and stabilising information system resources

This research found that each preventive care patient process includes different IS resources to develop IS competencies (Amit & Schoemaker 1993; Ashurst, Doherty & Peppard 2008). These IS competencies are embedded in organisational processes (Stalk, Evans & Shulman 1992; Teece 2000) and are bounded by the arrangement of people and the processes that exist in the hospital's departments (Peppard & Ward 2004). Further, the IS competencies are developed from accumulating and stabilising IS resources. *Accumulating* IS resources refers to a process of developing IS competencies internally (Sirmon et al. 2011). *Stabilising* IS resources refers to a process of making minor incremental improvement to IS resources to develop IS competencies (Sirmon et al. 2011).

For example, ABC, as a referral centre, accumulates IS resources to develop a competency in designing a preventive care treatment plan in the treatment and monitoring process by assigning a specialised team consisting of a consultant, a specialist, a doctor and nurses from certain departments to work in another district hospital (sister hospital) to provide preventive care services. Thus, ABC's intangible-IT resource that refers to the specialised team is accumulated when the healthcare

practitioners act as experts to share knowledge and skills in addition to learning from other healthcare practitioners at the district hospital.

Stabilising IS resources is closely related to this accumulating process. To continue from the previous example, stabilising occurs when ABC's specialists, doctors and nurses execute their knowledge and skills that have improved over time to deliver better preventive care service to patients. Thus, practising existing knowledge, and adding new accumulated knowledge and skills into ABC Hospital's current knowledge stocks, represent minor incremental improvements to stabilise IS resources to develop IS competencies: competency in designing preventive care treatment plan.

Moreover, this research found that through IS competency bundling, different IS resources may complement each other to create IS competencies, whereby a better quality of preventive care can be offered to patients (Chatzkel 2002). Thus, IS competency bundling, that is the combined effect of accumulating and stabilising IS resources creates IS competencies, can increase the benefits of IS resources (Pang, Lee & Delone 2014; Rothaermel & Hess 2007) that refer to the use of HIS; healthcare practitioner skills, knowledge, experiences and attitudes; customer orientation; synergy and knowledge assets.

6.3 Information system capability bundling through enriching competencies

Enriching refers to a process of extending current IS capabilities (Sirmon, Hitt & Ireland 2007) from a collective of IS competencies. Different outcomes can be achieved through different bundling of the IS competencies. Hence, proper mixing and matching of IS competencies formulate different sets of IS capability.

For example, developing the *capability of investigating and diagnosing a patient's health condition* in the preventive care patient investigation and diagnosis process involves a combination of three IS competencies – competency in patient medical information management, competency in supporting and bonding among healthcare practitioners and competency in HIS proficiency. This research found that IS capability bundling, that is, utilising a combination of different IS competencies, enriched IS capability to leverage the performance of preventive care. This is consistent with previous research that describes IS capabilities as a mutually reinforcing system of

practices and competencies (Aral & Weill 2007) that are characterised by business processes (Ray, Barney & Muhanna 2004), which in this research refers to the preventive care patient process.

Furthermore, this research has extended previous studies by Grant (1991), Bharadwaj (2000) and Peppard and Ward (2004) where resources do not directly create capabilities that are specific to the organisation. Instead, the results of this research suggest that the development of IS capabilities depend critically upon enriching a combination of different IS competencies that are developed by accumulating and stabilising IS resources. Moreover, the development of IS capabilities from IS resources → IS competences → IS capabilities → performance could be due to enhancing relationships, which explains the presence of one factor magnifying the impact of a different factor to achieve the desired performance (Black & Boal 1998, p.139). Thus, the findings of this research support the idea that IS capabilities are identified as a higher-level construct than IS competencies (Peppard & Ward 2004; Stalk, Evans & Shulman 1992), classified and portrayed from an enrichment of IS capability bundling and IS competency bundling.

6.4 Leveraging information system capabilities through positioning and exploiting capabilities for preventive care performance

This research found that IS capabilities are leveraged to achieve preventive care performance through positioning and exploiting the IS capabilities, unlike the findings of previous research (Sirmon et al. 2011; Sirmon, Hitt & Ireland 2007). *Positioning* refers to how a hospital matches its IS capabilities with the preventive care patient process to achieve preventive care performance. Specifically, positioning refers to how a hospital leverage IS capabilities through matching its internal IS capabilities with preventive care patient processes (Chatzkel 2002).

In this research, *exploiting* IS capabilities refers to using, developing (Levinthal & March 1993), refining and extending existing IS competencies (March 1991) within the hospital's limited resources to positively and accurately improve each preventive care patient process to achieve efficient and effective preventive care performance. For example, ABC Hospital achieves administrative efficiency through positioning IS capabilities in managing patient profiling with the preventive care patient registration

process. Subsequently, the capability in managing patient profiling is exploited to obtain accurate and complete patient background and health information, which enables the healthcare practitioners to assist patients to implement proper preventive care treatments.

Therefore, positioning the right IS capability to the right preventive care patient process indicates the ability of a hospital to exploit its IS capabilities for the proper execution of routines (Aral & Weill 2007) in the preventive care patient process (Ray, Barney & Muhanna 2004). Thus, the positioning and exploiting IS capabilities concepts extends Garicano and Wu's (2012) research by not only putting the right talent in the right position, but also exploiting the right capability as a strategy to improve the preventive care patient processes (Ray, Barney & Muhanna 2004) to achieve efficient and effective performance.

In summary, Figure 6.1 distils the above discussions on IS competency and IS capability development into a framework.

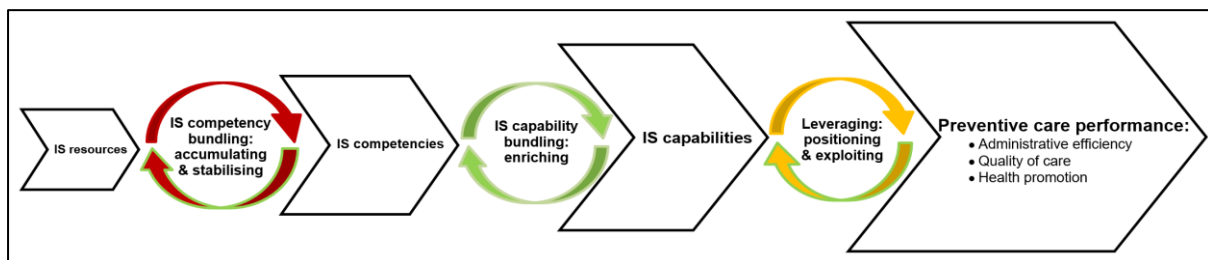


Figure 6.1: Framework of the development of information system competencies and information system capabilities for hospital preventive care performance

Note: IS = information system

6.5 Conclusion

This chapter synthesised the single case study conducted for this thesis. By synthesising this data, this thesis concludes that the case study exemplifies preventive care IS capability and IS competency development in a public hospital that depicts what and how IS competencies and IS capabilities are developed from the two types of resource bundling, which is different from Sirmon et al.'s (2011) conclusion.

Chapter 7 concludes this thesis, highlighting its theoretical and practical contributions, limitations and recommended future research.

CHAPTER 7 – CONCLUSION AND CONTRIBUTIONS

This thesis presented an analysis of IS competency and IS capability development based on two sub-research questions. The research analysed how a public hospital in a developing country integrates IS resources to develop these IS competencies and capabilities through two types of resource bundling processes. This research also analysed how a hospital leveraged its IS capabilities to achieve preventive care performance. In addition, this research investigated how healthcare practitioners apply IS competencies in order to support their tasks in each preventive care patient process and then leverage IS capabilities to achieve preventive care performance.

This research led to the following conclusion: the development of IS competencies and IS capabilities requires two types of resource bundling processes that enable the hospital to accumulate and stabilise its IS resources into IS competencies (IS competency bundling) and enrich a combination of different IS competencies to develop IS capabilities (IS capability bundling) to facilitate preventive care performance.

These elements and their connections are captured in the revised theoretical framework presented in Figure 7.1, which holistically incorporates the two types of resource bundling processes, and the leveraging process that connects IS resources to preventive care performance.

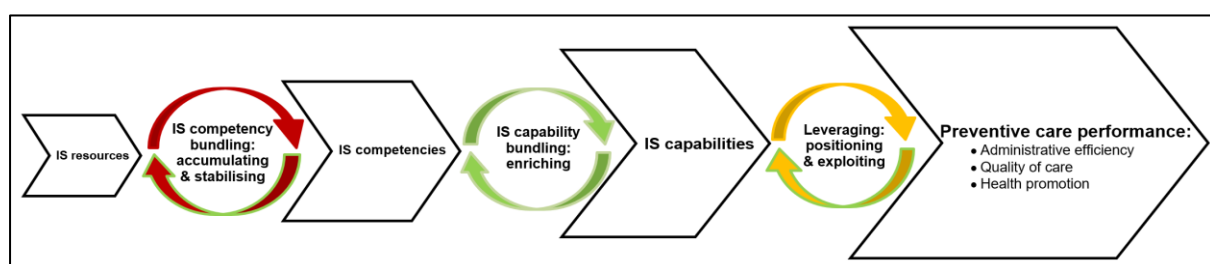


Figure 7.1: Framework of the development of information system competencies and information system capabilities for hospital preventive care performance

Note: IS = information system

This holistic framework is the first to present the development of IS competencies to IS capabilities from a resource orchestration perspective (Sirmon et al. 2011) and CEM (Davis-Sramek, Germain & Krotov 2015).

As depicted in Figure 7.1 first, the hospital integrates its IS resources through IS competency bundling by accumulating and stabilising IS resources to develop IS competencies. Second, through IS capability bundling, a combination of IS competencies are enriched to develop IS capabilities. Third, the IS capabilities are leveraged through positioning and exploiting to achieve preventive care performance that consists of administrative efficiency, quality of care and health promotion. In summary, this framework provides an explanation about how a hospital could integrate its IS resources through the two types of resource bundling to develop IS competencies and IS capabilities and thus achieve preventive care performance. This framework can be a useful tool for academics, as well as practitioners who are studying resource development and investigating how limited IS resources can be used strategically for preventive care performance.

7.1 Contribution of the research

The main lesson learned from this research is that a hospital should integrate its tangible, human and intangible-IT resources, such as its HIS, through two types of resource bundling – accumulating and stabilising – and enriching sub-processes to achieve preventive care performance in administrative efficiency, quality of care and health promotion. This lesson can be further broken down into theoretical and practical contributions.

7.1.1 *Theoretical contributions*

This research contributes to IS research through understanding how IS resources such as HIS can be integrated by looking through the lens of RBV theory. This is shown through the development of conceptual framework that reveals how IS resources contribute to IS competences and capabilities in order to leverage preventive care performance. This is outlined further below.

7.1.1.1 Theoretical contributions to resource development in the hospital preventive care literature

This research contributes to resource development in the hospital preventive care literature. It suggests that the link between IS resources and preventive care performance could be explained not only through the underlying mechanism of

orchestrating IS resources in the preventive care patient processes, as Ray, Barney and Muhanna (2004, p. 35) state, ‘what they do’, but also involves the development of IS competencies and capabilities, ‘what they are’ (Ray, Barney & Muhanna 2004, p. 35). Moreover, this research proposed a framework that provides a detailed structure with a process view of IS competency and capability development and their influence on preventive care (Halcomb et al. 2016) in local healthcare settings (Hersh et al. 2010). Thus, the development of IS competencies and capabilities through bundling derived from this research confirms and supports Peppard and Ward’s (2004) research finding; that through resource-level bundling IS competencies are developed at the organising level, and organising-level bundling results in IS capability development at the enterprise level.

7.1.1.2 Theoretical contribution to the preventive care literature in developing countries

This research examined and analysed the literature cited widely by authors about preventive care in developing countries. The analysis of the preventive care literature in Chapter 2 identified that there are four aspects of preventive care: administrative efficiency, health promotion, quality of care and cost effectiveness. This analysis of the literature provided better understanding about how preventive care of chronic diseases is a strategy for exploring preventive care performance. The research framework contributes to the preventive care literature by introducing three main interrelated aspects of preventive care concepts – the right foundation for administering preventive care with proper health promotion could improve the quality of preventive care delivery in developing countries.

7.1.1.3 Theoretical contribution to the hospital information system literature

This research contributes to the HIS literature by demonstrating that it can improve administrative efficiency, quality of care and health promotion in preventive care. This research shows how a hospital can integrate HIS with other healthcare resources to deliver quality preventive care services to patients.

The findings from this research concur with the HIS literature, which shows that HIS provides value when it is integrated with other IT resources. Most importantly, this research provides further insights not only on the role of HIS, but also into how HIS is

currently being integrated with other IS resources that comprise tangible-IT resources (HIS), human-IT resource (healthcare practitioner skills, knowledge, experiences and attitudes) and intangible-IT resources (customer orientation, synergy and knowledge assets) through IS competency bundling to develop IS competencies, and through IS capability bundling to develop IS capabilities for preventive care performance.

7.1.1.4 Theoretical contributions to resource-based view theory

This research contributes to RBV by confirming that resource orchestration is crucial in providing an adequate explanation towards understanding the complex interactions between IS resources, IS competencies and IS capabilities towards preventive care performance while addressing resource issues.

From the theoretical perspective, this research expands the theory through the application of the resource orchestration perspective to address how RBV has failed to adequately explain the process by which IS resources interact, create and influence performance (Liang, You & Liu 2010), and examine and explain the misleading concept of how RBV claims that the effect of resources has a direct impact on performance. The resource orchestration perspective extends the use of RBV by explaining that when IS resources are appropriately managed, they transform into IS competencies and capabilities, and through leveraging of IS capabilities, preventive care performance is achieved. Thus, the resource orchestration perspective explains the chain of effect that IS competencies were developed through resource bundling, and IS capabilities were developed from IS competency building that leads to an enterprise level strategy, that is, preventive care performance. Thus, this research unpacked the black box of something happens between resources and performance as questioned by Davis-Sramek, Germain and Krotov (2015).

This research provides evidence to further strengthen the research of Maritan and Peteraf (2011), Sirmon, Hitt and Ireland (2007), and Wade and Hulland (2004) in RBV by explaining not only how resources interact with one another and create value for IS competency (Maritan & Peteraf 2011; Sirmon, Hitt & Ireland 2007; Wade & Hulland 2004) but also how IS competency empowers IS capability as a company strategy to achieve preventive care performance. Thus, using RBV to understand the development of IS competencies and capabilities helps to address the resource issues

of underutilised resources, inadequate resources and inappropriate use of resources in hospitals.

This research contributes to the application of RBV in a not-for-profit organisation such as in public healthcare organisation (Ferlie 2004; Pee & Kankanhalli 2016). Majority of existing studies that draw on the RBV is focusing on for-profit and competitive context. By applying the RBV to a not-for profit context as opposed to a competitive orientation, this research reveals that competition is not just about focusing on competitive advantage in for-profit organisation but also can be in terms of achieving organisational performance such as quality improvement and values-driven strategy in non-profit organisation (Burton et al. 2014; Arik et al. 2016). In this research, the findings show preventive care performance in a public hospital includes administrative efficiency, health promotion and quality of care.

7.1.1.5 Theoretical contributions to the resource orchestration perspective in preventive care

The combination of resource orchestration with the use of CEM refines the resource orchestration perspective. This study confirms that the use of CEM (Davis-Sramek, Germain & Krotov 2015) addresses the limitations and extends the understanding of RBV in a meaningful new direction (Barney, Ketchen & Wright 2011). In addition, this thesis proposes that two types of resource bundling are responsible for the development of IS competencies and IS capabilities, thus further expanding on Sirmon et al.'s (2011) work on the resource orchestration perspective. The two types of resource bundling derived from the case analysis are first, IS competency bundling consists of accumulating and stabilising IS resources to develop IS competencies, and second, IS capability bundling consists of enriching a combination of different IS competencies to develop IS capabilities that can be leveraged for preventive care performance.

7.1.2 Managerial contributions

This research provides lessons about managing limited resources for preventive care for a targeted audience – hospital management in public hospitals in Malaysia that are currently providing, or going to implement, preventive care. It could help them address the constraints of underutilised resources, inadequate resources and inappropriate

use of resources. The following sections provide an explanation about these contributions.

7.1.2.1 Managerial contribution to public hospitals in Malaysia

Given the importance of utilising limited resources in preventive care, this research emphasises that managers of public healthcare in Malaysia need to understand how to strategically integrate limited resources within the hospital without incurring additional costs for preventive care delivery. IS capabilities provide strategic value that can be leveraged to facilitate preventive care performance. The recommendations below could be followed to introduce preventive care strategies while ensuring quality of care with limited resources:

- i. Promote the importance of joint learning and information sharing among the healthcare workforce so that preventive care knowledge and skills are transferred to Malaysian public hospitals.
- ii. Use the concept of train-the-trainer to continue educating these healthcare experts so that they are not only ready, but also able to, train others.
- iii. Collaborate and share the latest best practices through health promotion programs with other Malaysian public hospitals.

7.1.2.2 Managerial contribution to hospital management where preventive care is currently provided

Healthcare management could use the findings from this research to determine key resources and understand the way these resources can be integrated into healthcare practitioners' skills sets (IS competencies) and hospital potential (IS capabilities) that are used as strategies to offer efficient and effective preventive care. To assist hospital management, three strategies are proposed to resolve resource limitations, utilisation and misuse issues:

- i. Review the availability of limited resources and use creativity and innovation to integrate them to design strategies for internal resource development.
- ii. Encourage the experts to mentor junior healthcare practitioners throughout preventive care patient processes, so they deliver safer and better-quality preventive care.

- iii. Establish a care team on a volunteer basis within the hospital so that a conducive environment for preventive care services is nurtured.

These three strategies would allow a hospital to design and implement better-quality preventive care services within their limited resources.

7.1.2.3 Managerial contribution to hospital management where preventive care is planned

To excel in the direction of providing quality preventive care service delivery, hospitals need to focus on administrative, safety and quality of care, and health promotion. The findings from this research could be used as a reference to guide hospital management where implementation of preventive care is planned through the following steps:

- i. Mix-and-match different healthcare practitioners' strengths and skills to offer quality preventive care services to patients.
- ii. Conduct assessments of healthcare practitioners' knowledge, experience and skills to identify experts.
- iii. Provide preventive care training from the angle of administrative, safety and quality of care, and health promotion so that the hospital will be ready for preventive care implementation.

The three steps suggested above would allow hospital management to establish a plan for implementation of preventive care services.

7.2 Limitations and future research

There are some limitations in this research and recommendations for future research, as there are in all case studies, whether qualitative or quantitative. Sustaining patient health in the face of increasing chronic disease cases and meeting patient requirements for quality preventive care requires that hospitals continuously develop their resource base. Thus, this research focused on the nature of the development of the resources and capabilities that are most difficult to address in a single case of a public hospital.

The findings of this research are not meant to reflect the total population as in a quantitative study, nor can the research make general statements about all resource development based upon a single case study.

There was a constraint during participant selection because of my inability to have full control to select potential participants, mostly due to using the snowballing technique and voluntary participation. However, I believe that this research resulted in sufficient data to explore preventive care in ABC Hospital given that I reached the theoretical saturation point (Merriam 2009) with 60 interviews and followed general guidelines from the SPS approach to have a minimum of 15 participants with no repeat informants (Pan & Tan 2011).

Moreover, a single case study has not been conducted to achieve generalisability but to 'add situational examples to the readers' experience' (Stake 2010, p. 23). A single case study's ability to deal in depth with complexity from a particular situation (Yin 2003) would benefit future research about preventive care in developing countries. Thus, the case study in this research provides a basis for analytic generalisation; not by statistical methods to a population, but by developing and expanding the theories by comparing conceptual arguments developed from the literature with empirical results from the case study that has applicability beyond the setting studied (Yin 2016). By developing such a rich theoretical framework, it is intended for it to be used as a vehicle for generalisation in resource development in the preventive care context.

Future researchers could apply the proposed theoretical framework to other organisations and test the utility of the framework. For instance, more empirical findings with respect to the same phenomena should be generated from multiple cases that include a few hospitals that operate in different sectors, such as the private sector, or in different countries, which may enable cross-country studies. One avenue for future research on the development of IS resources for preventive care in the private sector would be to examine how resource orchestration differs in a profit-making healthcare institution. Additional research is therefore required if future researchers want to obtain a better understanding of how to orchestrate resources in private organisations with a dynamic environment to facilitate preventive care.

Moreover, the complex resource development and interactions between resources and capabilities reveal the existence of indirect relationships that necessitate researchers to use more sophisticated quantitative and qualitative research designs. Structural equation models that can reveal the individual effects of all constructs with all details can be used for this purpose. Additionally, qualitative investigations, such as ethnography and in-depth interviews should be combined with quantitative studies to explore some of the best practices for strengthening the links between IS competencies and IS capabilities in preventive care. Also, this research leaves it to future researchers to measure the extent of overlap in IS competencies, perhaps by using large-scale surveys to identify whether particular IS competencies are more important than others for specific preventive care patient processes.

Furthermore, this research clearly does not account for all the important elements that influence the development of IS competencies and IS capabilities in public organisations. This research recognises that there could be other equally influential factors such as religion and cultural values. For example, as the empirical data show, the way healthcare practitioners expressed their sympathy while trying to console patients diagnosed with an advanced level of chronic disease may depend a lot on their strong religious belief and the culture they live in. These values are translated into their strength, as a nurse in ophthalmology department put it:

Nurse H #29: In terms of spiritual, we assist patients (patient with diabetes and stroke) to perform their prayers. We give them support, we know how they are feeling, we understand what they have gone through, that's why we always encourage them to be strong and always pray to God so that they will always be strong to go through this.

Thus, more research is needed to examine the role of such forces in shaping specific types of IS competencies and IS capabilities towards preventive care performance.

Finally, three aspects were included in preventive care performance – administrative efficiency, quality of care and health promotion. The cost effectiveness aspect that was introduced in the literature (Probstfield 2003) could not be included because the findings were limited. This is because the case study is a highly subsidised government hospital (Risso-Gill et al. 2015) with most of its care delivery services, medications and health devices provided free for most of the chronic diseases

(Farooqui et al. 2011) and designed based on providing affordable healthcare (Rahman et al. 2016). Thus, healthcare practitioner understanding about treatment cost to patient outcome is limited. Moreover, controlled data on government hospital cost structures may be another reason for limited discussion about cost effectiveness. Since the cost cannot be accounted for in this case study, it is not included in this thesis. Although the three aspects of preventive care are considered among the most suitable and concrete indicators for this context, the additional aspect of cost effectiveness is recommended for inclusion in future studies in other hospitals with preventive care services.

7.3 Final reflections

As an overall reflection, ABC Hospital provided me with a rich case study to explore how its IS resources can leverage preventive care performance. However, while the scarcity of resources for healthcare organisations, including ABC Hospital, is a constraint especially in preventive care area – ABC can do more with its existing resources. Evidence from this research points clearly to how the limited available resources are integrated in order to develop the IS competencies and capabilities to facilitate preventive care. Therefore, this research has been a worthwhile exercise in which the participants have provided positive feedback on how this hospital has helped them as healthcare practitioners to understand and strengthen their roles, thus improve preventive care service. I believe that this research has answered the research questions and benefits ABC Hospital specifically. Clearly, efforts to improving the preventive care service for chronic diseases in ABC Hospital is expanding, particularly now its healthcare practitioners are increasingly organising awareness campaigns, providing specialised advice and preventive care treatment not only at the hospital level, but also in the community.

Finally, this research has also contributed to the research community through an understanding of the development of IS competencies and capabilities. The framework provides a novel way of linking the theories and perspectives of resource development that can be used in a general way by healthcare organisations to discover how IS resources are integrated to maximum effect, which in turn can lead to significant benefits for preventive care service.

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APPENDICES

Appendix 1: Preventive care concepts

Authors	Preventive care concept	Focus
Gordon (1983)	<p>Universal prevention addresses the entire population (for example, national, local community, school, and district) and aims to prevent or delay risk factor exposure. All individuals, without screening, are provided with information and skills necessary to prevent the problem.</p> <p>Selective prevention focuses on groups whose risk of developing problems is above average. The subgroups may be distinguished by characteristics such as age, gender, family history, or economic status.</p> <p>Indicated prevention involves a screening process.</p>	A three-tiered preventive intervention classification system on the basis of the population
Rebelsky et al. (1996)	<p>Preventive service is categorised into:</p> <p>A Request-Only focus, no initiative on prevention just recommendation,</p> <p>A Health-Maintenance Visit focus, provide services during visits, as scheduled,</p> <p>Opportunistic-Prevention focus, provide services at every chance.</p>	Preventive service based on physician philosophies
Solberg et al. (1996)	Preventive services are divided into three levels of priority; essential, important and useful.	Prevention process with various levels of priority
Solberg et al. (1997)	Preventive services include processes of screen, follow-up, track or recall, summarise, resource, patient activation, cue, counselling and prevention visit with guideline as the main foundation.	Specific preventive care process
Solberg, Kottke and Brekke (1998)	Preventive services include processes such as clinic guidelines, screening, status summary, reminders, resources, follow-up, counselling, outreach, prevention visits and patient activation.	Specific preventive care process
Solberg et al. (1998)	Using the same concept of preventive care from Solberg, Kottke and Brekke (1998).	Specific preventive care process
Kenkel (2000)	<p>Primary prevention consists of actions that reduce the occurrence or incidence of disease. This category includes not only vaccinations and other medical care but, perhaps more importantly, public sanitation measures and health lifestyle decisions such as regular exercise and non-smoking.</p> <p>Secondary prevention consists of actions that reduce or eliminate the health consequences of a disease given its occurrence. Many clinical preventive services delivered during periodic health examinations fall into this category. Screening for cardiovascular disease, cancer, diabetes and other chronic illnesses allows early detection and treatment, presumably leading to better outcomes.</p> <p>Tertiary prevention consists of actions that reduce disability associated with a chronic illness. Educating diabetic patients on foot care to prevent complications is an example.</p>	Preventive care category

Authors	Preventive care concept	Focus
Glasgow, Orleans and Wagner (2001)	Preventive care is one effort to identify the care system describing each component of care processes for clinical preventive services such as screening and summarising of preventive needs.	Specific preventive care process
Carpiano et al. (2003)	Preventive service delivery includes all screening, counselling and immunisation services.	Specific preventive care process
WHO (2004)	<p>Primordial prevention: Actions and measures that inhibit the emergence and establishment of environmental, economic, social and behavioural conditions, cultural patterns of living, etc., known to increase the risk of disease.</p> <p>Primary prevention: The protection of health by personal and community-wide effects. Primary prevention involves measures provided to individuals to prevent the onset of a targeted condition.</p> <p>Secondary prevention: Measures that identify and treat asymptomatic persons who have already developed risk factors or preclinical disease, but in whom the condition is not clinically apparent. These activities are focused on early case finding of asymptomatic disease that occurs commonly and has significant risk for negative outcome without treatment.</p> <p>Tertiary prevention: A process aimed at limiting the negative effects of an established disease.</p>	Preventive care category
WHO (2007)	<p>Primary prevention: to avoid the development of disease.</p> <p>Secondary prevention: recognise a disease before it results in morbidity (or co-morbidity).</p> <p>Tertiary prevention: to reduce the negative impact of established disease by restoring function and reducing disease-related complications.</p>	Preventive care category
Tian, Chen and Liu (2010)	Preventive care is divided into two which are the primary service focus on the prevention for instance immunisation and secondary service the early detection and diagnosis.	Preventive care category
Bousquet et al. (2011)	<p>Follow the definition from WHO (2007)</p> <p>Primary preventive: to avoid the development of diseases</p> <p>Secondary preventive: to identify the disease before it results in morbidity</p> <p>Tertiary preventive: to reduce negative effect for existing diseases by restoring function and reducing the complications of related diseases.</p>	Preventive care category
Jusot, Or and Sirven (2012)	Used definition from Kenkel (2000).	Preventive care category
Ogden, Richards and Shenson (2012)	Clinical preventive services ‘... include immunisations, disease screening, and counselling interventions.’ p. 419	Specific preventive care process

Authors	Preventive care concept	Focus
Emanuel (2012)	<p>'Primary preventative strategies (treating healthy people to avoid disease), such as vaccination, and secondary strategies (diagnosing and treating people who are at risk of developing disease) remain critical interventions. p.1433</p> <p>'Tertiary prevention improves the care of patients with serious and often multiple chronic illnesses, and it requires extending responsibility for their health beyond the hospital and physician's office'. p.1433</p>	Preventive care category
Krist et al. (2013)	Preventive care includes three key components: engagement, administration, and follow-up.	Stages of preventive care delivery
Hoeck et al. (2014)	<p>Primary prevention (immunisation) could prevent health problems</p> <p>Secondary prevention or early diagnosis (blood cholesterol and blood sugar measurement) gives opportunities for better treatment.</p>	Preventive care category
McMorrow, Kenney and Goin (2014)	Management of diseases for example appropriately screening, diagnosis and treatment of chronic diseases.	Specific preventive care process
Bartlem et al. (2016)	Preventive care was assessed with respect to clinician provision of three elements of care: assessment, brief advice, and referral/arranging ongoing support.	Specific preventive care process
Cabral and Cullen (2017)	Used definition from Kenkel (2000).	Preventive care category
(Sabbath et al. 2018)	Preventive care is measured through visits included annual physical exams, cancer screenings (breast, cervical, colon, prostate), vaccinations, routine gynaecological care, screening for chronic conditions (diabetes, hyperlipidemia), and genetic screening.	Specific preventive care process

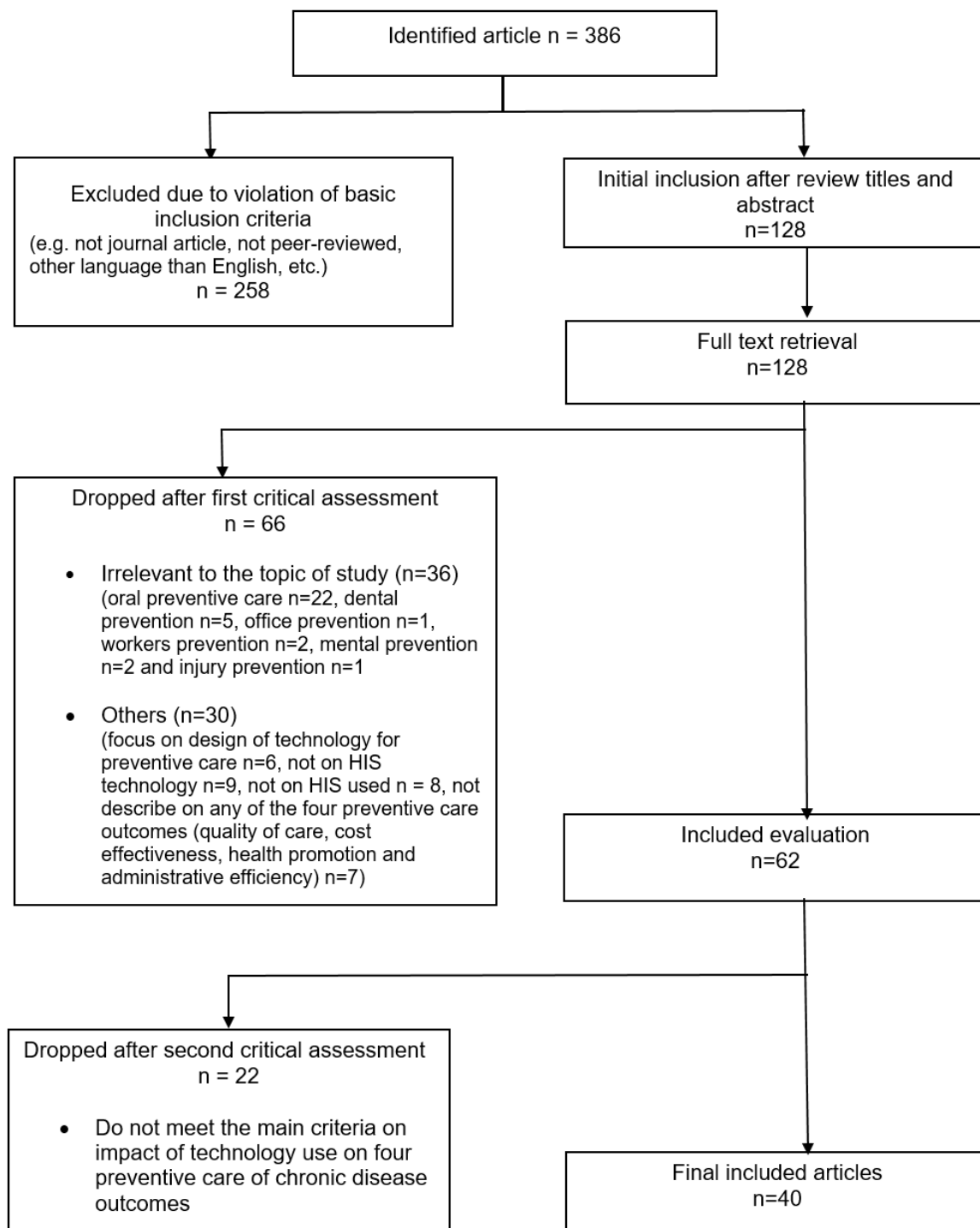
Appendix 2: Type of hospital information systems used in different countries

Author	Country	Type of technology	Global adoption				
			NA	E	AP	A	ME
Peng, Dey and Lahiri (2014)	United States	Clinical data repository	/				
Vu and Nguyen (2010)	Vietnam	Laboratory information system			/		
Warrick et al. (2011)	England	Clinical information system		/			
Hosseini et al. (2014)	Iran	HIS					/
Ehteshami et al. (2013)	Iran	Intensive care information system					/
Ahmad and Tsang (2013)	United States	EHR	/				
Geanuracos et al. (2007)	United States and Puerto Rico	Geographic information system	/				
Howland et al. (2015)	New York	Electronic health registration	/				
Oluoch et al. (2014)	Kenya	EMR					/
O'Sullivan, Billing and Stokes (2011)	Australia and New Zealand	EHR			/		
Yoshida, Imai and Ohe (2013)	Japan	HIS			/		
Shu et al. (2014)	China	EHR			/		
Watkinson-Powell and Lee (2012)	Nepal	EMR			/		
Overhage, Grannis and McDonald (2008)	United States	Electronic Laboratory	/				
Were et al. (2010b)	Uganda	EMR					/
Zinszer et al. (2013)	Canada	HIT	/				
Shih et al. (2011)	New York	EHR	/				
Adler-Milstein, Kvedar and Bates (2014)	United States	Telehealth	/				
Adler-Milstein and Bates (2010)	United States	EHR	/				
Ahmadian et al. (2014)	Iran	HIS					/
Amin, Hussein and Isa (2011)	Malaysia	HIS			/		
Babamir and Arabfard (2012)	Iran	HIS					/
Lee, Ramayah and Zakaria (2012)	Malaysia	HIS			/		
Handayani, Rahman and Hidayanto (2013)	Indonesia	HIS			/		
Haque et al. (2013)	Bangladesh	HIS			/		
Zakaria and Yusof (2016)	Malaysia	HIS			/		
Huri et al. (2016)	Malaysia	HIS			/		

Author	Country	Type of technology	Global adoption				
			NA	E	AP	A	ME
Bernardi (2017)	Kenya	HIS				/	
Askar, Ardakani and Majdzade (2017)	Somalia	HIS				/	
Moghaddasi et al. (2018)	Oman, Bahrain	HIS					/
Lacson et al. (2018)	United States	HIT	/				
Rasmi et al. (2018)	Jordan	EHR					/
Dwyer and Rizzo (2018)	United States	HIT	/				

Note: NA = North Africa; E = Europe; AP = Asia Pacific; A = Africa; ME = Middle East; HIS = hospital information system; EHR = electronic health record; EMR = electronic medical record; HIT = Health information technology

Appendix 3: Flow diagram of inclusion and exclusion of studies on HIS impact on preventive care outcomes (Adapted from Surchkre et al. (2012) and McElwaine et al. (2016))



Appendix 4A: Studies reporting the impact of health information system on preventive care and healthcare performance and its analysis

Author	Country	Technology	Type of chronic disease	Evaluate on	Influence on preventive care performance				Influence on healthcare performance
					Quality of care	Cost	Health promotion	Administrative efficiency	
Lin et al. (2014)	China	EHR	Not specified	Creation of health records and workflow	+ (Yes)				
Lacson et al. (2018)	US	HIT	Lung cancer	Follow-up	+ (Yes)				
Hay et al. (2017)	US	ICT	Type 2 DM	Improved QALYs, DFDs, and medical costs	+ (Yes)	+ (Yes)			
Keehbauch et al. (2012)	US	EMR	Obesity in children	Education, documentation			+ (Yes)	+ (Yes)	
Burke et al. (2016)	US	EHR	Type 2 DM		- (No) Did not improve quality of care + (Yes)				
Prince and Herrin (2007)	US	Patient response platform computerised system	Congestive heart failure and other disease					+ (Yes)	
Shaw et al. (2011)	US	EMR	Not specified	Chronic disease prevention and screening-information retrieval, data extraction and the integration of care	+ (Yes) Quality of care				
Bauer et al. (2014a)	US	HIT	Type of chronic diseases not specified	Health literacy for supporting patient engagement in care			+ (Yes)		

Author	Country	Technology	Type of chronic disease	Evaluate on	Influence on preventive care performance				Influence on healthcare performance
					Quality of care	Cost	Health promotion	Administrative efficiency	
Shen et al. (2015)	USA	EHR			+ / - (Mix)	+			
Van Dyck et al. (2012)	UK	Diagnostic and monitoring technology	CVD	Treatment cost, incremental net benefit and QALYs		+			
Howard et al. (2013)	US	EHR	General (chronic disease prevention)	Check in and room, chart their work, communicate with both patients and providers, lab-related tasks				+ / - (Mix)	
Vollmer et al. (2014)	US	EMR	CVD	Medication adherence	+ (Yes)				
Misono et al. (2010)	US	HIT	CVD & DM	Reminder system, education and counselling	+ (Yes)			+ / - (Mix)	
Gilmer et al. (2012)	UK	EMR-based CDS	DM	Evaluate remaining life years, QALYs, and health care costs over patient lifetimes	+ (Yes)	+			
Appari et al. (2012)	US	CPOE and eMAR	CVD	Medication administration				+ (Yes)	
Connelly et al. (2012)	US	EHR	Heart failure	Hospitalisation, mortality, LOS, and numbers of tests, procedures, and medications ordered	+ / - (Mix)				

Author	Country	Technology	Type of chronic disease	Evaluate on	Influence on preventive care performance				Influence on healthcare performance
					Quality of care	Cost	Health promotion	Administrative efficiency	
Kazley and Teufel (2015)	US	EHR	Respiratory		+ / - (Mix)				
Midboe et al. (2011)	US	CDS	General (chronic diseases)	Medication management				+ (Yes)	
Bardhan and Thouin (2013)	US	HIT	Heart attacks, heart failures, and pneumonia.	Hospital operating expense and the process quality	+ (Yes)	+ (Yes)			
Shelley et al. (2011)	US	EMR and CDS	Hypertension and cardiovascular		+ (Yes)			+ (Yes)	
Rief et al. (2017)	US	HIT	Coronary artery disease, congestive heart failure, or either hypertension or hyperlipidemia	Patient communication, partnering with providers; and awareness and proactivity in tracking	+ (Yes)		+ (Yes)		

Author	Country	Technology	Type of chronic disease	Evaluate on	Influence on preventive care performance				Influence on healthcare performance
					Quality of care	Cost	Health promotion	Administrative efficiency	
Agha (2014)	US	HIT	Acute myocardial infarction, stroke, hip fracture, lung cancer, colon cancer, gastrointestinal haemorrhage, or pneumonia	Quality of care (patient mortality, adverse drug events, and readmission rates) and medical costs	- (No)	- (No)			
Seblega et al. (2015)	US	HIT	Acute myocardial infarction, congestive heart failure, pneumonia	Patient safety and quality of care	- (No)				
Nilsson, Skär and Söderberg, (2010)	Sweden	General-various ICT	General chronic disease	Accessibility to nursing care through communication	+ (Yes)				
Franklin et al. (2015)	US	General-various ICT	CVD	Promote health self-behaviour			+ (Yes)		
Boushey et al. (2009)	US	IT	Overweight	Assess diet preferences				+ (Yes)	
Jimbo et al. (2006)	US	IT	Cancer	Patient reminder on cancer screening				+/- (Mix)	
Mishuris and Linder (2014)	US	EHR	Breast, cervical and colon cancer	Screening examination	+ (Yes)				

Author	Country	Technology	Type of chronic disease	Evaluate on	Influence on preventive care performance				Influence on healthcare performance
					Quality of care	Cost	Health promotion	Administrative efficiency	
McCullough et al. (2010)	US	EHR and CPOE	Heart failure and pneumonia	6 quality measures- <u>Heart failure patient:</u> ACE inhibitor/ARB use, Smoking cessation advice, <u>Pneumonia patient:</u> Pneumococcal vaccination, Blood culture preceded antibiotic, Smoking cessation advice Most appropriate antibiotic	+ (Yes)				
Frimpong et al. (2013)	US	HIT	General-chronic disease	Receipt of discharge summaries, the use of a patient notification system for preventive and follow-up care, and appointment for specialty care	+ (Yes)				
Chen and Wilkosz (2014)	US	IT	Overweight /obesity	Physical activity and healthy dietary behaviours	+/- (Mix)				
Chaudhry et al. (2006)		HIT	Type of chronic diseases not specified	Enhanced monitoring and surveillance activities, reduction of medication errors, and decreased rates of utilisation for potentially redundant or inappropriate care	+ (Yes)	+/- (Mix)			

Author	Country	Technology	Type of chronic disease	Evaluate on	Influence on preventive care performance				Influence on healthcare performance
					Quality of care	Cost	Health promotion	Administrative efficiency	
Gaikwad and Warren (2009)		Technology	Type of chronic diseases not specified		+ (Yes)	+ (Yes)			
Gilmore et al. (2014)	US	Technology	Obesity	Health behaviours	+ (Yes)				
Kaufman (2011)	US	Technology	DM		+ (Yes)				
Leeman-Castillo et al. (2010)	US	Interactive computer system	Heart disease	Promoting healthy diets and behaviour			+ /- (Mix)		
Carter et al. (2012)	UK	ICT	Obesity	Quality of care - dietary assessment and obesity monitoring	+ (Yes)				
Cebul et al. (2011)	US	EHR	DM	Quality of care	+ (Yes)				
Moody-Thomas et al. (2015)	US	EHR	Coronary heart disease	Quality of care (tobacco use screening, treatment, and quit rates)	+ (Yes)				
Yusof (2015)	Malaysia	CCIS	Not specified						+(Yes) Quality of care, cost, administrative)
Park and Lee, (2014)	Seoul, Korea	EMR	Not specified	Length of stay					+ (Yes) Quality of care

Author	Country	Technology	Type of chronic disease	Evaluate on	Influence on preventive care performance				Influence on healthcare performance
					Quality of care	Cost	Health promotion	Administrative efficiency	
Cho et al. (2013)	Korea	EMR	Not specified	Length of stay					+ (Yes) Quality of care
(Lee, Wan and Kwon (2012)	US	HIS	Not specified	Cost in hospital					-(No) Do not impact on cost
Devaraj, Ow and Kohli (2013)	US	General IT	None	General - hospital efficiency and performance					+ (Yes) (reduce financial performance and increase quality of care)
Selck and Decker (2016)	US	HIT	None	General - hospital efficiency-waiting time, visit length and resource use					+ (Yes) (reduce waiting time, visits increased, increase number of test ordered, increase in the number of medications and images ordered per visit. + (Yes) (facilitate on health promotion)
Nimkar (2016)	US	IT	None	General - on health promotion					+ / - (Mix) (quality of care in ambulatory care)
Jean-Jacques et al. (2011)	US	HIT	None	General - quality of care					+ / - (Mix) (quality of care in ambulatory care)
Ker et al. (2014)	US	IT	None	Medication distribution processing time and cost					+ (Yes) (Quality of care and cost: Reduce processing time, reduce cost)

Author	Country	Technology	Type of chronic disease	Evaluate on	Influence on preventive care performance				Influence on healthcare performance
					Quality of care	Cost	Health promotion	Administrative efficiency	
Roham, Gabrielyan and Archer (2012)	Canada	HIT	None	Patient satisfaction					+ (Yes) (Quality of care)
Ker et al., (2014)	Canada	EMR	None	Prescribing support, disease management, clinical documentation, work practice, preventive care, and patient-physician interaction					+/- (Mix) Quality of care
Gaylin et al. (2011)	US	HIT	None	General					+ (Yes) General- Healthcare quality, costs and privacy
Kitsantas, Moncada and Abdul (2016)	US	HIT	None	Quality of patient care through patient registries					+ (Yes) Quality of care
Cohen, Coleman and Abrahams (2015)	US	E-health	Not specified	Quality of care					+ (Yes) Quality of care +/- (Mix) Efficiency
Agarwal and Sebastian (2014)	US	CPOE	Not specified	Quality of care - entering medial records					+ / - (Mix) Quality of care
Black et al. (2011)		E-health technologies	Not specified	Quality and safety of care					+/- (Mix) Quality of care

Author	Country	Technology	Type of chronic disease	Evaluate on	Influence on preventive care performance				Influence on healthcare performance
					Quality of care	Cost	Health promotion	Administrative efficiency	
Hosseini et al. (2014)	Iran	HIS	Not specified	Hospital cost (paper use, stages of hospital and procedures) Quality of care (speed of services)					+ (Yes) Hospital cost + (Yes) Speed of services
Oluoch et al. (2014)	Kenya	EMR	HIV	Compliance with clinical guidelines					+ (Yes) Quality of care
Watkinson-Powell and Lee (2012)	Nepal	EMR	Not specified	Continuity of care Monthly report creation					+ (Yes) Quality of care
O'Sullivan, Billing and Stokes (2011)	Australia and New Zealand	EHR	Not specified	Medical information, confidentiality of information, ability to access records, nutritional treatment monitoring, reports creation to referring doctors					+ (Yes) Quality of care and administrative efficiency
Were et al. (2011)	Africa	Computer-generated reminders	HIV	Adherence test					+ (Yes) Quality of care
Were et al. (2010b)	Africa	EMR	HIV	Clinical summaries					+ (Yes) Quality of care
Nohara et al. (2015)	Bangladesh	e-health and telemedical	Obesity, hypertension, DM	Health check-up		+ (Yes) cost			

Author	Country	Technology	Type of chronic disease	Evaluate on	Influence on preventive care performance				Influence on healthcare performance
					Quality of care	Cost	Health promotion	Administrative efficiency	
Hameed et al. (2016)	India	IT	CMD (i.e. DM, CVD, and kidney disease)	Diagnosis, treatment and prevention					

Note: EHR = electronic health record; HIT = hospital information technology; ICT = information and communication technology; EMR = electronic medical records; CDS = clinical decision support; CPOE = computerised physician order entry; eMAR = electronic medication administration records; CVD = cardiovascular disease; CDS = clinical decision support system; IT = information technology; CCIS = critical care information system; HIS = hospital information system; HIV = human immunodeficiency virus; CMD = cardiometabolic diseases; DM = diabetes mellitus; QALYs = quality-adjusted life years; LOS = length of stay

Appendix 4B: Summary of analysis and references of studies compiled from the review

Number of studies: 40				
Results:	Positive	Negative	Mix	Total
HIS impact on one preventive care performance:				
Quality of care	1, 2, 7, 12, 24, 28, 29, 30, 34, 35, 37, 38, 39	5, 23	16, 17, 31	18
Cost effectiveness	10, 62	-	-	2
Health promotion	8, 25	-	36	3
Administrative efficiency	15, 18, 26	-	11, 27	5
HIS impact on more than one preventive care performance:				
Quality of care and cost effectiveness	3, 14, 19, 33	22	9, 32	7
Quality of care and health promotion	21	-	-	1
Quality of care and administrative efficiency	6, 20	-	13	3
Health promotion and administrative efficiency	4	-	-	1
Total				40

Appendix 5: Application of the resource orchestration perspective

	Author	Title	Application of resource orchestration perspective
1.	Gong et al. (2018)	Supply chain	Investigation of how multinational corporations orchestrate their internal and external resources to help their supply chains to learn sustainability.
2.	Badrinarayanan, Ramachandran and Madhavaram (2018)	Sales literature	Review of the research on two specific perspectives of resource orchestration and dynamic capabilities and their application in sales, focusing on the role of sale managers in developing and leveraging organisational resources to achieve salesforce, customer and organisational outcomes.
3.	Hughes et al. (2018)	Manufacturers	Through orchestrating different resource configurations as a strategy, manufacturers, specifically their operations managers, can maximise profitability.
4.	Symeonidou and Nicolaou (2018)	Start-up phase	Examination of how entrepreneurs can manage their resources to achieve higher performance in start-ups by accounting for three key contingencies of resource orchestration: human capital investment relative to rivals, leveraging strategy, and founder start-up experience.
5.	Li and Jia (2018)	IT-enabled innovation in manufacturing firm	Utilisation of the resource orchestration perspective and the dual role of IT as an operand resource and as an operant resource-impacts on innovation processes and innovation outcomes in manufacturing firms.
6.	Carnes et al. (2017)	Innovation in different life-cycle stage (growth and maturity stage)	Investigation of how firms orchestrate their resource portfolios to build capabilities to facilitate innovations based on the firm's growth and maturity life-cycle stages.
7.	Miao et al. (2017)	Entrepreneurial orientation	A firm's entrepreneurial orientation, through the dimensions of proactiveness, innovation, and risk-taking, can enable an organisation to reconfigure its resource portfolio and mobilise resources to achieve firm performance.
8.	Cui et al. (2017)	E-commerce enabled social innovation	Utilisation of the concept of resource orchestration as a theoretical lens to develop a fit model that explicates how resources are orchestrated under the guidance of either an indigenous, exogenous or collaborative strategy to achieve e-commerce enabled social innovation.
9.	Liu et al. (2016)	Supply chain integration	Utilisation of resource orchestration to understand how to deploy and configure different degrees of supply chain integration and various IT competency portfolios to achieve superior firm performance.
10.	Yi et al. (2016)	Effect on strategic change speed	Examination of how the managerial capability involved in resource bundling approaches (i.e. stabilising, enriching, and pioneering) affect the speed of strategic change, and how managerial ties (i.e. government ties, customer ties and supplier ties) as external resources influence the effects of resource bundling capabilities on strategic change speed.

	Author	Title	Application of resource orchestration perspective
11.	Lanza, Simone and Bruno (2016)	Knowledge resource acquisition and divestment	Research in the context of <i>Serie A</i> , the Italian top-level professional football league, from 1960 to 1992. Examination of how resource orchestration in the context of knowledge resource decisions concerning the acquisition of new resources in the form of new employees' experience and the release of such resources in the form of the dismissal of co-specialised resources can affect team experience and performance.
12.	Cui and Pan (2015)	Manufacturers' e-commerce adoption	Application of the resource orchestration perspective as a theoretical lens to explain how enterprises develop focal capability through resource orchestration actions to achieve a successful e-commerce adoption processes in a dynamic environment.
13.	Kamasak (2015)	Manufacturing firm performance	Investigation of the complex interaction of different resource sets and capabilities on firm performance, finding that the most important determinants of firm performance include organisational culture, reputational assets, human capital, business processes and networking capabilities.
14.	Davis-Sramek, Germain and Krotov (2015)	Supply chain	Examination of how research and development investment as a key resource and enabler of knowledge generation impacts firm performance through a chain of events.
15.	Chadwick, Super and Kwon (2015)	Chief executive resource orchestration on strategic human resource management	Examination of the effect of chief executive resource orchestration in a multi-industry sample of 190 Korean firms, suggesting that chief executive emphasis on strategic human resource management has primary effects on firm performance through commitment-based human resource systems.
16.	Wong, Wong and Boon-Itt (2015)	Supply chain	Stakeholder and resource orchestration theories can be used to explain an integrative approach of environmental management in supply chains and proposed a theoretical framework for future research.
17.	Koufteros, Verghese and Lucianetti (2014)	Performance measurement system uses	Utilisation of the resource orchestration perspective to view performance measurement system uses and explore specific relationships of underlying variables by relying on the organisational information processing theory.
18.	Ketchen, Wowak and Craighead (2014)	Supply chain	Importance of to examining shortfalls in resource orchestration to better understand the role of resources in supply management as this will enhance knowledge of how and why product recalls happen, as well as the type of product recall and how to remedy the problems that led to the recall.
19.	Wales et al. (2013)	Entrepreneurial orientation	Examination of the relationship between entrepreneurial orientation and small firm performance, suggesting that the resource orchestration perspective will help small firms overcome their liabilities of smallness and will enable managers to orchestrate their information and communication technology resources and network resources to improve performance and obtain returns from entrepreneurial orientation.
20.	Wright and Stigliani (2013)	Entrepreneur	Investigation of how the process of resource orchestration occurs to facilitate growth with respect to how entrepreneurs access and configure resources.

	Author	Title	Application of resource orchestration perspective
21.	Wright, Clarysse and Mosey (2012)	Entrepreneur	Utilisation of strategic entrepreneurship perspective and resource orchestration perspective to provide an integrated framework that show different resources need to be synchronised at different stages of growth across types of university spin-offs.
22.	Chirico et al. (2011)	Entrepreneurial orientation	In family firms, entrepreneurial orientation provides the necessary mobilising vision to structure, bundle, and leverage knowledge and experiences acquired through intergenerational involvement of individuals in family firms.
23.	Sirmon et al. (2011)	Suggestion on resource orchestration application	The resource orchestration framework could be applied to understand resource management across a firm's breadth (scope of the firm), depth (at different organisational levels), and life cycle (different stages of a firm's evolution) and has significant implications for how organisations can improve performance.

Appendix 6: RMIT Ethics Approval



Deputy Pro Vice-Chancellor
(Research & Innovation)
College of Business

GPO Box 2476
Melbourne VIC 3001
Australia

Tel: +61 3 9925 5432
Fax: +61 3 9925 5624

Notice of Approval

Date: 15 March 2016

Project number: 19934

Project title: *Developing Preventive Care Capabilities from the Hospital Information System (HIS) Adoption: A Case Study in Malaysian Public Hospital*

Risk classification: Low Risk

Chief Investigator: Dr Say Yen Teoh
Student Investigator: Dr Leslie Young
Other Investigator: Noor Fadzlina Mohd Fadhill

Project Approved: From: 15 March 2016 To: 20 July 2019

Terms of approval:

Responsibilities of the principal investigator

It is the responsibility of the principal investigator to ensure that all other investigators and staff on a project are aware of the terms of approval and to ensure that the project is conducted as approved by BCHEAN. Approval is only valid while the investigator holds a position at RMIT University.

1. *Amendments*
Approval must be sought from BCHEAN to amend any aspect of a project including approved documents. To apply for an amendment submit a request for amendment form to the BCHEAN secretary. This form is available on the Human Research Ethics Committee (HREC) website. Amendments must not be implemented without first gaining approval from BCHEAN.
2. *Adverse events*
You should notify BCHEAN immediately of any serious or unexpected adverse effects on participants or unforeseen events affecting the ethical acceptability of the project.
3. *Participant Information and Consent Form (PICF)*
The PICF must be distributed to all research participants, where relevant, and the consent form is to be retained and stored by the investigator. The PICF must contain the RMIT University logo and a complaints clause including the above project number.
4. *Annual reports*
Continued approval of this project is dependent on the submission of an annual report.
5. *Final report*
A final report must be provided at the conclusion of the project. BCHEAN must be notified if the project is discontinued before the expected date of completion.
6. *Monitoring*
Projects may be subject to an audit or any other form of monitoring by BCHEAN at any time.
7. *Retention and storage of data*
The investigator is responsible for the storage and retention of original data pertaining to a project for a minimum period of five years.

Appendix 7: MREC approval for conducting a case study



JAWATANKUASA ETIKA & PENYELIDIKAN PERUBATAN
(Medical Research & Ethics Committee)
KEMENTERIAN KESIHATAN MALAYSIA
d/a Institut Pengurusan Kesihatan
Jalan Rumah Sakit, Bangsar
59000 KUALA LUMPUR



Tel.: 03-2287 4032/2282 0491/2282 9085
03-2282 9082/2282 1402/2282 1449
Faks: 03-2282 0015

Ruj. Kami : (5) KKM/NIHSEC/P16-650
Tarikh : 29 April 2016

DR. SAY YEN TEOH
LESLIE WILLIAM YOUNG
NOOR FADZLINA BT MOHD FADHIL

ROYAL MELBOURNE INSTITUTE OF TECHNOLOGY (RMIT) UNIVERSITY

Tuan/puan,

NMRR-16-579-30003 (IIR)
DEVELOPING PREVENTIVE CARE CAPABILITIES FROM HOSPITAL INFORMATION
SYSTEM (HIS) ADOPTION: A CASE STUDY IN MALAYSIAN PUBLIC HOSPITAL

Lokasi Kajian:



Dengan hormatnya perkara di atas adalah dirujuk.

2. Jawatankuasa Etika & Penyelidikan Perubatan (JEPP), Kementerian Kesihatan Malaysia (KKM) tiada halangan, dari segi etika, ke atas pelaksanaan kajian tersebut. JEPP mengambil maklum bahawa kajian tersebut hanya melibatkan pengumpulan data melalui kaedah temu bual sahaja.

3. Segala rekod dan data subjek adalah **SULIT** dan hanya digunakan untuk tujuan kajian ini dan semua isu serta prosedur mengenai *data confidentiality* mesti dipatuhi.

4. Kebenaran daripada Pegawai Kesihatan Daerah/Pengarah Hospital dan Ketua-Ketua Jabatan atau pegawai yang bertanggungjawab disetiap lokasi kajian di mana kajian akan dijalankan mesti diperolehi sebelum kajian dijalankan. Tuan/puan perlu akur dan mematuhi keputusan tersebut. Sila rujuk kepada garis panduan Institut Kesihatan Negara mengenai penyelidikan di Institusi dan fasiliti Kementerian Kesihatan Malaysia (Pindaan 01/2015) serta lampiran *Appendix 5* untuk templet surat memohon kebenaran tersebut.

5. Adalah dimaklumkan bahawa kelulusan ini adalah sah sehingga **28 April 2017**. Puan perlu menghantar perkara-perkara berikut kepada JEPP selepas mengikut kesesuaian. Borang-borang berkaitan boleh dimuat turun daripada laman web MREC (<http://www.nih.gov.my/mrec>).

- I. Borang ***Continuing Review Form*** perlu dihantar ke JEPP selewat-lewatnya 2 bulan sebelum tamat tempoh kelulusan ini bagi memperbaharui kelulusan etika.
 - II. ***Study Final Report*** perlu dihantar ke JEPP pada penghujung kajian.
 - III. Mendapat kelulusan etika sekiranya terdapat pindaan ke atas sebarang dokumen kajian/ lokasi kajian/ penyelidik.
6. Sila ambil maklum bahawa sebarang urusan surat-menyurat berkaitan dengan penyelidikan ini haruslah dinyatakan nombor rujukan surat ini untuk melicinkan urusan yang berkaitan.

Sekian terima kasih.

"BERKHIDMAT UNTUK NEGARA"

Appendix 8: Plain language statement and participant consent form



School of Business Information
Technology and Logistic

Building 80
Swanston Academic Building
Melbourne VIC 3000

GPO Box 2476
Melbourne VIC 3001
Australia
www.rmit.edu.au

INVITATION TO PARTICIPATE IN A RESEARCH PROJECT

PARTICIPANT INFORMATION

Project Title:

Developing Preventive Care Capabilities from Hospital Information System (HIS)
Adoption: A Case Study in Malaysian Public Hospital.

Investigators:

Principle Research Student: Noor Fadzlina Mohd Fadhil, PhD Candidate, School of
Business Information Technology and Logistic, RMIT University, Melbourne, Australia
Email: [REDACTED]

Chief Investigator: Dr. Say Yen Teoh, Senior Lecturer, School of Business Information
Technology and Logistic, RMIT University, Melbourne, Australia
Email: [REDACTED]

Co-Investigator: Dr. Leslie Young, Senior Lecturer, School of Business Information
Technology and Logistic, RMIT University, Melbourne, Australia
E-mail: [REDACTED]

Dear participant,

*You are invited to participate in a research project being conducted by the School of
Business Information Technology and Logistic, RMIT. Please read this sheet carefully
and be confident that you understand its contents before deciding whether to participate.
If you have any questions about the project, please ask one of the investigators.*

Who is involved in this research project? Why is it being conducted?

The investigator is a PhD student enrolled in the School of Business Information
Technology and Logistic, RMIT University. The research project is being supervised by
senior supervisor, Dr. Say Yen Teoh and associate supervisor, Dr. Leslie Young who are
senior lecturers in the School of Business Information Technology and Logistic, RMIT
University.

This research explores the use of Information System (IS) resources in promoting the
preventive care in Malaysia. It aims at understanding the use of Hospital Information

System (HIS), IS competencies and IS capabilities in influencing the hospital performance, specifically the preventive care.

Why have you been approached?

You have been approached to participate in this research because the researcher(s) believe that you have the expertise, skills and knowledge that can help to provide relevant information related to the study. It is important to note that an official permission has been granted by the hospital director and the National Institute of Health (NIH) Malaysia to conduct this study. The recruitment process is as below:

- (i) A particular department with list of names are determined in the meeting with the director. The list of participants will consist of healthcare practitioners with the expertise, skills and knowledge and have the potential to provide relevant information related to the study.
- (ii) The CRC Unit will provide the list of names and contact numbers of participants via e-mail to the researcher(s). At the same time, the CRC Unit will advise those who are listed, to personally contact the researcher(s) if they are interested to participate in the study. This way participant can opt-in rather than opt-out and the organisation will not know the final participants except the researcher(s).
- (iii) The participants' identities are kept confidential throughout the study.

What is the project about? What are the questions being addressed?

The purpose of the research is to examine how [REDACTED] achieved its preventive care by utilizing its IS resources, IS competencies and IS capabilities in HIS adoption.

The research objectives are as follows: -

1. To explore the HIS used in public hospital to promote the preventive care.
2. To identify the processes that enabled the HIS to be utilized in developing the preventive care capabilities in public hospital.
3. To investigate how the processes are developed and interacted in developing the preventive care capabilities in public hospital.

If I agree to participate, what will I be required to do?

If you agree to participate, you will be engaged in an interview that will last for approximately 60 minutes with the researcher (Noor Fadzlina Mohd Fadhil), and you will be required to fill in the consent form (*Appendix 1*) if you decide to participate.

Participants have the right to agree to the interviews being recorded. If not, then the interviewer can take notes. You have the right and freedom to request that taping cease at any time during the interview process. An outline of the research questions for the interview will be provided together with this consent form.

What are the possible risks or disadvantages?

The possible risk exists is the potential identification due to the small participant pool. However, the number of participants is sufficient for the study and is large enough to keep the anonymity. The organisation will not know the final list except the researcher(s) because CRC Unit will advise those who are interested to contact the researcher(s) personally. Moreover, we will make sure that participants' confidentiality and privacy

are strictly maintained during all stages of the research. Your participation is voluntary and you are entitled to decide not to participate in this research.

Besides, there is one disadvantage, regarding time factor. This study will need some of your time commitment for the interview session that will take approximately up to 1 hour. However, with your involvement, you could have the opportunity to share your views on the topic of study, which is a valuable contribution to your hospital and benefiting the public.

If you are unduly concerned about your responses to any of the interview questions, or if you find participation in the project distressing, you should contact

- Dr. Say Yen Teoh, Senior Lecturer or Chief Researcher, School of Business Information Technology and Logistic, RMIT University, Melbourne. Contact No: [REDACTED] or Email: [REDACTED] or Malaysia persons in-charge:
 - [REDACTED] Deputy Director of CRC Unit, [REDACTED] Hospital. Contact No. [REDACTED] ext: [REDACTED] or E-mail: [REDACTED]
 - [REDACTED], Deputy Director (Medical), [REDACTED] Hospital. Contact No: [REDACTED] ext: [REDACTED] or E-mail: [REDACTED]

What are the benefits associated with participation?

Your organization will receive a final report containing a summary of the project. In the report, you will find valuable insights on the preventive care capabilities from HIS adoption for [REDACTED] Hospital. Besides, the preventive care capabilities framework could insights as well as providing possible solutions to solve the challenges in preventive care and chronic diseases. Our study will benefit the hospital in improving its development plans for preventive care using the technology driven in the organization.

What will happen to the information I provide?

Confidentiality and privacy will be strictly maintained during all stages of the research. Information that you provided will not be directly passed on to your organization. Only de-identified quotations and/or numbers will be used in reporting results, which will be made public in the forms of thesis, journals and conferences.

Any information that you provide can be disclosed only if (1) it is to protect you or others from harm, (2) if specifically required or allowed by law, or (3) you provide the researcher(s) with written permission. All electronic data will be stored on password secured university network systems. Hard copy data will be archived in the locked filing cabinet and locked office at School of Business Information Technology and Logistic at RMIT University. The research data will be kept securely at RMIT for 5 years after publication, before being destroyed. Please note that due to the nature of data collection we will be requesting written informed consent from you.

What are my rights as a participant?

Your participation in this research is completely voluntary. There are no penalties if you decide not to participate. As a participant, you have the right:

- to withdraw from participation at any time
- to request that any recording cease
- to request for a final report or outcome of the research study

- to have any unprocessed data withdrawn and destroyed, provided it can be reliably identified, and provided that in doing so does not increase the risk for the participant;
- to be de-identified in any photographs intended for public publication, before the point of publication; and
- to have any questions answered at any time.

Whom should I contact if I have any questions?

If you have any questions or enquiries regarding this project or your participation you can contact

- Dr. Say Yen Teoh, Senior Lecturer or Chief Researcher, School of Business Information Technology and Logistic, RMIT University. Contact No: [REDACTED] or Email: [REDACTED] or you also can pass on any concerns and request information from Malaysia persons in-charge:

[REDACTED]

What other issues should I be aware of before deciding whether to participate?

There are no other issues that you should be aware of as a participant.

Yours sincerely,

NOOR FADZLINA
PhD candidate
RMIT University

DR. SAY YEN TEOH
Senior Lecturer
RMIT University

DR. LESLIE YOUNG
Senior Lecturer
RMIT University

If you have any concerns about your participation in this project, which you do not wish to discuss with the researchers, then you can contact the Ethics Officer, Research Integrity, Governance and Systems, RMIT University, GPO Box 2476V VIC 3001. Tel (03) 9925 2251 or email human.ethics@rmit.edu.au

Appendix 9: Sample interview guide

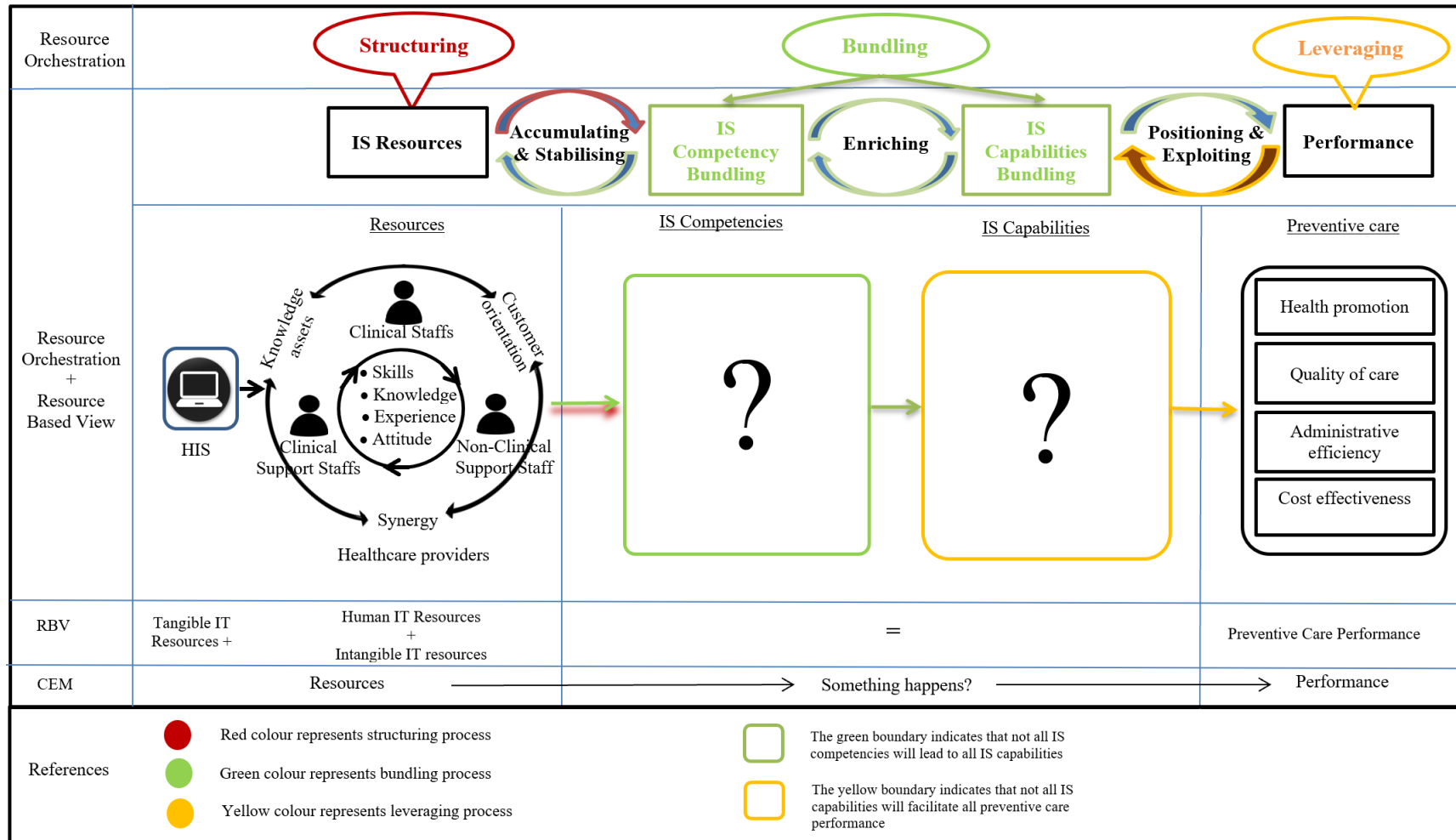
	Position: Specialist <input type="radio"/> Doctors <input type="radio"/> Nurses <input type="radio"/> Others <input type="radio"/> (Please specify): _____ Date: _____ Day: _____ Time: _____ Place: _____ Could you please tell me a bit more about your work and your job descriptions or responsibilities?									
E	Preventive care									
No	Question									
1.	<p>How does your hospital define preventive care or in your own understanding what is preventive care to you?</p> <ul style="list-style-type: none"> Do you think preventive care is important and why do you think it is important? Please give an example. What is your commitment to ensuring that preventive care is properly delivered? In your perspective are there any different levels of preventive care services provided to patients? Who is involved and what are their roles in each level of preventive care? Please give examples? <table border="1"> <thead> <tr> <th>Level</th><th>Description</th></tr> </thead> <tbody> <tr> <td>Primary prevention</td><td>to avoid the development of the disease.</td></tr> <tr> <td>Secondary prevention</td><td>recognise a disease before it results in morbidity (or co-morbidity).</td></tr> <tr> <td>Tertiary prevention</td><td>to reduce the negative impact of established disease by restoring function and reducing disease-related complications.</td></tr> </tbody> </table> <p><i>*can skip this question if the hospital has a standard definition of preventive care.</i></p>	Level	Description	Primary prevention	to avoid the development of the disease.	Secondary prevention	recognise a disease before it results in morbidity (or co-morbidity).	Tertiary prevention	to reduce the negative impact of established disease by restoring function and reducing disease-related complications.	
Level	Description									
Primary prevention	to avoid the development of the disease.									
Secondary prevention	recognise a disease before it results in morbidity (or co-morbidity).									
Tertiary prevention	to reduce the negative impact of established disease by restoring function and reducing disease-related complications.									
2.	<p>What are the main challenges that you faced in providing preventive care services? How you overcome these challenges?</p> <ul style="list-style-type: none"> How do you help them to overcome these challenges if there are no standard operating procedures to provide proper supports? (admin) Who is the champion or leader (formal or informal) in this initiative? How did he or she support this initiative? Please give examples. In order to provide better preventive care services, do you think it is necessary for you and your colleague (doctor or nurses etc.) to go through special training or education? Why do you think so? Could you give us an example how it has helped? 									
	PROCESS 1: Structuring - HIS and Healthcare practitioners									
A	Tangible-IT resource known as physical IT resource; Hospital Information System (HIS)									
No	Question									
3.	<p>In your opinion, how HIS is used in delivering effective preventive care? Please give examples.</p> <ul style="list-style-type: none"> What is the most challenging experience that you have in delivering effective preventive care using HIS? Why? How do the knowledge, collaboration and patients care (knowledge assets, synergy and customer orientation) interact when you use HIS? How your behaviour, knowledge, experience and skills change after using the HIS in delivering preventive care? 									
B	Human-IT resources e.g. knowledge, skills, experience, and attitude									
No	Question									
4.	<p>What are the requirements (e.g. skills, knowledge, experience, and behaviour or attitude) needed for healthcare practitioners in using HIS for preventive care?</p> <ul style="list-style-type: none"> Why do you think those are important? How are these requirements develop IS competencies to deliver the preventive care? How do you think HIS can help you? 									

5.	As healthcare practitioners, how do you apply your knowledge, skills, and experience to develop IS competencies and enhance IS capabilities for a better quality of care for your patients?	
C	Intangible-IT resources consist of knowledge assets, synergy and customer orientation	
No	Question	
6.	What would be most helpful for you in your practice to improve your ability to introduce and discuss preventive health screening with patients by using HIS? <ul style="list-style-type: none"> Do you find that synergy, customer orientation, and knowledge assets are important aspects for achieving effective preventive care to patients? 	
7.	How do you practise your work as teamwork in delivering quality preventive care? <ul style="list-style-type: none"> Was there any collaboration (synergy) between healthcare practitioners when delivering the preventive care to patients? How has the collaboration given rise to IS competencies and improve IS capabilities in performing better preventive care to patients? 	
	PROCESS 2: Bundling - IS Competencies and IS Capabilities	
D	IS competencies & IS capabilities	
No	Questions	
8.	What are the necessary skills required in order to make full use of your knowledge, skills, experience and best attitudes for successful preventive care? <ul style="list-style-type: none"> How does the collaboration, patients care and your knowledge (synergy, customer orientation, knowledge asset) can help create IS competencies, then improve IS capabilities for preventive care? How does your care team use HIS to provide good patient care (customer orientation) that further enhances IS capabilities for providing efficient administration, quality of care and cost to your patients? 	
9.	How does this quality can improve the hospital's ability to deliver successful preventive care using HIS? <ul style="list-style-type: none"> How does your IS competencies help to improve the IS capabilities which can empower the administration of preventive care? Has that improve the quality of care and reducing healthcare cost? How do the IS competencies and IS capabilities improve preventive care? <ol style="list-style-type: none"> <u>Stabilising</u> <ul style="list-style-type: none"> What are the preventive care services given to patients in the primary, secondary and tertiary level of preventive care? Please give examples. Why are these services so important at each level? <u>Enriching</u> <ul style="list-style-type: none"> How can you improve the existing or current preventive care services given to patients? Please give examples. How these services can add values or enhance the existing or current services? Why does this improvement important at each level of preventive care? <u>Pioneering</u> <ul style="list-style-type: none"> What are the specialties in preventive care services in this hospital compared to others? Please give examples. How does the preventive care services different from other hospitals? Why these new preventive care services important at each level of preventive care? 	
	PROCESS 3: Leveraging - IS capabilities towards Preventive Care	
No	Questions	
10.	What sorts of competencies are required in order to develop necessary capabilities to provide more effective preventive care? How do IS capabilities influence preventive care?	

	<ul style="list-style-type: none"> • Do the IS capabilities help in providing efficient patient administrative? How? Please give examples. • Do the IS capabilities help in providing quality of care? How? Please give examples. • Do the IS capabilities help in providing cost-effective treatment? How? Please give examples. 	
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End of questions.

Appendix 10: Logic models



Appendix 11: Sample of a table of matrix display






















Table of matrix display 1: Summary of codes, categories and themes of IS competencies for preventive care		
Codes	Categories	Themes/concepts for IS competencies
<p>Level 1 codes (in-vivo and holistic codes)</p> <p>-interview patient, patient history, patient's profile patient's general information, clerk -retrieve information, have access, recall back, place reviews -invent, create diet, compare blood investigation, decide, want to know the findings from investigation -ensure the data is correct, check again, confirm back -much safer systematic, avoid mistakes</p> <p>-diagnose patient, inform patient, explain, accept the result, next procedures -patient progress, monitor, patient's sign, patient's condition, give instructions</p> <p>-make friends, ask directly, play our role, -we have to do this, we don't have any choice, become our responsibility, person in charge, must sign, deal with people -I will do whatever I can, we have great tasks, we are very close with our patients</p> <p>-communicate effectively, discuss, refer to senior, peri team -convince, face to face and explain -we work in one place, work in team, teamwork, team up, -learn, learning, search for new information,</p> <p>-easy, save a lot of time, not a hassle -pass report, update news, know patient in advanced</p> <p>-counselling, counsel, flipchart, one-to-one, explain -advice carer, teach carer, explain, educate</p>	<p>Level 2 codes (grouping the same codes into categories)</p> <p>Profiling competency Data management competency Data-analysis competency Data quality competency Privacy and confidentiality competency Reducing medical errors competency</p> <p>Competency in designing customised patient care plan Competency in monitoring and evaluate patient progress</p> <p>Develop working relationship among colleagues Responsibility and professionalism competency Work commitment competency</p> <p>Communication skill competency Convincing skills and strategy Competency in continual improvement for skills and teambuilding Competency in continual improvement for knowledge and service delivery</p> <p>IT proficiency competency Information integration competency</p> <p>Educate patient on medication and devices Assisting and guiding carer to involve in patient care</p>	<p>Level 3 codes: themes (search for patterns to develop themes)</p> <p>Competency in patient medical information management</p> <p>Competency in designing preventive care treatment plan</p> <p>Competency in supporting and bonding among healthcare practitioners</p> <p>Competency in skills development and teambuilding among healthcare practitioners</p> <p>Competency in HIS proficiency</p> <p>Competency in providing education and counselling for patient and family members</p>

Table of Matrix Display 2: Summary of processes, healthcare practitioners', IS competencies and IS capabilities for preventive care							
Process	Themes for IS competencies for preventive care (derived from Table of Matrix Display 1)	IS Competencies (skill sets categories based on healthcare practitioners' roles)					Themes for IS capabilities for preventive care
		Doctor	Nurse	Pharmacist	Physio	Dietician	
1. Patient access	1.Competency in patient medical information management	Patient profiling	Patient profiling				Capability in managing patient profiling
	3.Competency in supporting and bonding among healthcare practitioners	Support others and build relationship					
2. Patient investigation and diagnosis	1.Competency in patient medical information management	Data management	Data management				Capability in investigating and diagnosing patient health condition
	3.Competency in supporting and bonding among healthcare practitioners	Effective use of IT	Data analysis				
	5. Competency in HIS proficiency	Information integration					
3. Patient evaluation after investigation and diagnosis	1.Competency in patient medical information management	Work commitment	Data management	Data analysis	Data management	Data analysis	
	2.Competency in designing preventive care treatment plan	Data analysis					
		Competency in designing customised patient care plan	Competency in designing customised patient care plan		Data quality	Competency in designing customised patient care plan	
4. Patient treatment and monitoring the progress	1.Competency in patient medical information management	Data management	Data management	Data management	Data management	Competency in monitoring and evaluate patient progress	Capability in mapping patient health condition to the right type of preventive care
	2.Competency in designing preventive care treatment plan	Reducing medical errors	Data quality	Continual improvement skills & teambuilding	Competency in designing customised patient care plan	Communication skill	
	4.Competency in skills development and teambuilding among healthcare practitioners	Continual improvement (skills and teambuilding)	Competency in monitoring and evaluate patient progress	Competency in designing customised patient care plan		Continual improvement skills and teambuilding	
	5. Competency in HIS proficiency	Competency in designing customised patient care plan	Competency in designing customised patient care plan	Competency in monitoring and evaluate patient progress		Effective use of IT	
			Effective use of IT	Reducing medical errors			

5.	Patient evaluation after treatment and monitoring	2.Competency in designing preventive care treatment plan 6. Competency in providing education and counselling for patient and family members	Competency in designing customised patient care plan	Competency in monitoring and evaluate patient progress Competency in designing customised patient care plan	Effective use of IT Data analysis	Providing patient and carer with education and counselling	Competency in designing customised patient care plan Provide diet counselling	
6.	Patient maintenance	3.Competency in supporting and bonding among healthcare practitioners 6. Competency in providing education and counselling for patient and family members	Work commitment	Data management Reducing medical errors		Provide patient and carer with education and counselling	Responsibility and professionalism	Capability in sustaining patient health condition

Appendix 12: Sample of a table of resource mapping

Resources for capability 2

Resources	Competency 1					Competency 2		Competency 3			Competency 4				Competency 5		Competency 6	
	1 Profiling	2 Data management	3 Data analysis	4 Data quality	5 Reducing medical errors	6 Designing customised patient care plan	7 Monitor & evaluate patient progress	8 Develop working relationship among colleagues	9 Responsibility & professionalism	10 Work commitment	11 Communication skill	12 Convincing skill	13 Continual improvement for skills & teambuilding	14 Continual improvement for knowledge & service delivery	15 IT proficiency	16 Information integration	17 Educating patient on medication & devices	18 Assisting & guiding carer in patient care
																		
Tangible-IT																		
Technical a. Sufficient hardware & reliable software		 19, 21, 22  14	 14												 20, 21, 19	 19		
Managerial a. IT team																		
b. 24/7 help desk																		
Human-IT																		
In-house training a. ITD-short course		 19, 22  14													 20, 21	 19		
b. Coaching-mentor mentee		 21, 22								 21					 21			
c. Talk by colleague										 11								
d. Presentation															 19			
e. Bedside teaching																		
f. Orientation			 14															
Outside training a. Seminar from outside																		
b. Outside courses																		
Continuous education a. Attachment																		
b. Post-basic			 14															
c. Further in specialisation																		
Engaging staff a. Passion																		
b. Trust & staff talent																		